S
419
A2

JUN 18 1928

VOLUME II NUMBER 2

AGRICULTURAL HISTORY

APRIL
1928

PUBLISHED QUARTERLY BY
THE AGRICULTURAL HISTORY SOCIETY
WASHINGTON, D. C.

Application for second class mailing privileges has been made at Baltimore, Md.

Made in United States of America

AGRICULTURAL HISTORY

VOLUME II APRIL, 1928 NUMBER 2

CONTENTS

Page

PLANT PATHOLOGY; A REVIEW OF THE DEVELOPMENT OF THE SCIENCE IN THE UNITED STATES..... 49
B. T. GALLOWAY

ANCIENT AGRICULTURE—PART I..... 61
ELLEN CHURCHILL SEMPLE

THE AGRICULTURAL MUSEUM; AN EARLY AMERICAN AGRICULTURAL PERIODICAL. 99
CLARIBEL R. BARNETT

NEWS NOTES AND COMMENTS..... 103

Publication Office Mt. Royal and Guilford Avenues, Baltimore, Md.

Published by the Agricultural History Society and supplied to its members. Annual membership dues, $2.00; life membership, $100.00. Secretary-Treasurer and Editor, O. C. Stine, Bureau of Agricultural Economics, United States Department of Agricultural, Washington, D. C.

THE AGRICULTURAL HISTORY SOCIETY

President

JOSEPH SCHAFER, Wisconsin State Historical Society

Vice-President

F. D. FARRELL, Pres., Kansas State Agr. College

Secretary-Treasurer

O. C. STINE, United States Department of Agriculture

Executive Committee

RODNEY H. TRUE, University of Pennsylvania
LYMAN CARRIER, Coquille, Oregon
O. C. STINE, United States Department of Agriculture
HERBERT A. KELLAR, McCormick Library, Chicago
E. E. DALE, University of Oklahoma
R. W. KELSEY, Haverford College
A. O. CRAVEN, University of Illinois
C. R. BALL, United States Department of Agriculture

The Agricultural History Society was founded in Washington, D. C. in 1919 and incorporated in 1924. At present the Society has two hundred and forty members in the United States and foreign countries. An annual meeting is held in Washington in the spring or early summer. Through an affiliation agreement, the Society holds a session and dinner in connection with the annual meeting of the American Historical Association.

Three volumes of AGRICULTURAL HISTORY PAPERS have been published with the assistance of the American Historical Association, and distributed separately by the Society.

In 1927 the Society began the publication of *Agricultural History*, a quarterly journal. Two numbers were published during the first year. Plans are being made for quarterly issues in 1928.

Correspondence concerning contributions, manuscripts, books for review, and membership, should be sent to the Editor.

AGRICULTURAL HISTORY

VOLUME II APRIL, 1928 NUMBER 2

PLANT PATHOLOGY; A REVIEW OF THE DEVELOPMENT OF THE SCIENCE IN THE UNITED STATES[1]

BY B. T. GALLOWAY

Senior Plant Pathologist, United States Department of Agriculture[2]

FORCES THAT MAKE HISTORY

The diseases of plants have attracted attention since the beginning of history. Blights and mildews are ancient words and our oldest books treating of agricultural practices are replete with them. Plant pathology as a science, however, is an infant among sciences; so young, in fact, that it can scarcely be said to have a history.

One is seldom privileged to present a historical review of a subject the genesis of which lies within the purview of one's own life. And yet, that is the situation in which I find myself at this time. I am speaking, of course, largely from the stand-

[1] Read at the Tenth Annual Meeting of the Agricultural History Society, Washington, D. C., September 13, 1927.

[2] Dr. B. T. Galloway was born and spent his early years in Missouri. He received a B.Agr.Sc. degree from the University of Missouri in 1884; during 1884–86, he worked as an assistant in the horticultural department of his Alma Mater. In 1887, he began his work in the U. S. Department of Agriculture as an assistant in the Section of Mycology of the Division of Botany. He served as a pathologist and as chief of the Division of Vegetable Pathology and Physiology from 1888 to 1901. In the latter year, he became Chief of the Bureau of Plant Industry. He served as Assistant Secretary of Agriculture during 1913–14. He then became dean of the State College of Agriculture, Cornell University. In 1916, he returned to the U. S. Department of Agriculture as Senior Plant Pathologist. This position, he still holds. Dr. Galloway has served as an agricultural explorer in Japan, China, India, and North Africa; he has written a number of works on botany, horticulture, and diseases of plants and their treatment.

point of the development of plant pathology in our own country. I believe it was Ferrero, the Italian historian, who said that the great motivating forces that make history are seldom recorded. It is the results of these forces and not the forces themselves that come to be put down as history. It is said that the introduction of the grape into the husbandry of the Roman people profoundly affected the whole Roman Empire, leading to far-reaching economic, political and social changes.

The outbreak of the American potato disease, or potato mildew, in western Europe, including England and Ireland, in 1845, and the advent of the American grape-vine mildew in France some years later made history and much of it. So, in the treatment of my subject, I would like, with your permission, to deal with it partly from the standpoint of what appears to be the forces that brought about certain results that we call history.

A TRANSITION PERIOD

Prior to 1845 the farmer had little reason to concern himself with what happened to his crops in the way of losses through the ravages of pests of various kinds. He took the losses as a matter of course. In fact, the farmer at that time and for some years later was a passive rather than an active factor in agriculture and agricultural progress and development. Lands were plentiful and cheap, great improvements were being made in machinery and methods, transportation facilities were rapidly being revolutionized with the result that export trade in agricultural products was growing by leaps and bounds. There were no troublesome agricultural surpluses in those days. This transition period in American agriculture lasted about twenty-five years or until about 1870. In a quarter of a century we passed from the scythe to the self-binder and from the horsedrawn wagon and canal boat to the steam railroad and ocean-going steam vessel. During that period there was more or less reckless regard for the future of farming. Soils were mined and little attention was paid to the great problems of conservation. Land speculation was rife. Then came a reaction, resulting in reduced prices and reduced crop yields. The competition of foreign

countries was keen. Wise, far-seeing men began to voice warnings which eventually resulted in steps being taken looking toward betterment of conditions and the creation of a consciousness that wastage must stop. Education came to be regarded as the key-note to the situation.

FOUNDATION OF EDUCATIONAL WORK

The conditions I have briefly touched upon led to such important steps as the organization of agricultural land grant colleges in each state and the establishment of the federal Department of Agriculture at Washington. These broad general movements looking toward education as the future solution of agricultural problems carried with them many minor and specific movements having to do with crop production. Among these were movements to control the losses to major crops like corn, wheat, oats, cotton and potatoes, due to the so-called smuts, rusts, blights, mildews and rots. European botanists had interested themselves in some of these troubles and there was considerable foreign literature on the subject. Prior to the year 1870, however, there was practically no home-developed knowledge on these subjects, and to the great mass of farmers and fruit growers plant diseases were mysteries and the losses therefrom were accepted as providential and unpreventable.

It was just a little over fifty years ago that the first steps were taken in this country looking toward the advancement of knowledge of plant diseases. Courses of study were inaugurated at Harvard University under the late Dr. W. G. Farlow, and at about the same time the late Dr. T. J. Burrill, of the University of Illinois, began teaching the subject. Dr. Chas. E. Bessey was another pioneer in this field, establishing courses of study in what was called cryptogamic botany or the study of fungi; first at the Ames, Iowa, Agricultural College, and later at the University of Nebraska.

PLANT PATHOLOGY NOT RECOGNIZED AS A SCIENCE

Following the footsteps of the few European specialists, plant pathology as such was not recognized in this country as a science.

In fact, the name was not in use in connection with the study of the diseases of plants. Even Julius von Sachs, the great European botanist, in his classic history of botany, published in 1889, makes no mention of plant pathology. Interest at the time of which we are speaking, 1870–1880, centered around the fungi, their life history and the manner in which they attacked higher plants. This work came to be called Mycology, and the first courses in our colleges were largely courses in Mycology, or studies of fungi. The writings of Farlow, Burrill and Bessey on mycological subjects and plant diseases from 1873 to 1880, coupled with some excellent work of a few foreign cryptogamic botanists, laid the foundation for the science of plant pathology which had its genesis in America a few years later.

PEASANTIZED AGRICULTURE NOT WANTED

The period from 1870 to 1886 was fraught with movements and developments profoundly affecting the future of agriculture in the United States. It was during this period that there developed a consciousness, not specifically expressed but nevertheless manifested in various ways, that America must look forward to something better than a peasantized agriculture. Every old country had that kind of agriculture, sometimes disguised and not always recognized, but nevertheless a peasant type. It was this awakening to the realization that America must develop a new type of husbandry, one in which the farmer should stand on an equal footing with those in other fields of industry, that led to marked advances in agricultural educational work, culminating in the establishment of agricultural experiment stations in each state of the Union under the so-called federal law known as the Hatch Act, and greatly enlarging the scope and power of the state agricultural colleges. The growing sentiment for agricultural progress was furthermore reflected in increased federal appropriations for the United States Department of Agriculture and a general broadening of the scope of its work.

The organic act establishing the Department of Agriculture (1862) provided, among other branches, a division of botany. For nearly twenty years this division had devoted its energies

largely to systematic studies of the grasses and gave some incidental attention to weeds and weed pests. Looking back on that period, the funds appropriated and spent for botanical work seem pathetically small. For nearly twenty years the entire botanical work of the Department was conducted with funds seldom exceeding $5,000 per annum.

BEGINNING OF PATHOLOGICAL WORK IN THE UNITED STATES DEPARTMENT OF AGRICULTURE

In 1885, largely through the activities of Prof. F. Lamson-Scribner, a Section of Mycology was established in the Division of Botany, of the Department of Agriculture. This was the first serious effort looking toward plant pathological work made by the federal government. Not much was accomplished by this small section during the first two years of its existence. Very little money was available and it was difficult to arouse interest even among the department officials. In fact, from a number of quarters there was downright opposition to the work. Such opposition nearly always develops when new and untried fields of research are opened. The establishment of the state experiment stations at about this time and the growing demand for help on the part of fruit growers, farmers and gardeners, coupled with an awakened consciousness that agriculture must go forward, enabled those who were steering the little ship of plant disease studies to hold their own. I well remember conditions as I found them when I came to the department as assistant to Professor Scribner forty years ago (1887). Here they are in a nutshell as I remember them.

The whole department was working under an appropriation considerably less than half a million dollars annually. The major portion of these funds was going into statistical work. Statistical work and the distribution of seed through members of Congress were the major activities. For plant disease studies about $8,000 a year was available. The entire force engaged in the plant disease work consisted of four trained men and one woman, together with three or four clerks. Two or three of the states were engaged in plant disease studies, but their fields were

very limited owing to lack of funds and lack of trained men. In the spring of 1888 Professor Lamson-Scribner left the Department and I was placed in charge of the young and struggling Section of Mycology. We had no Secretary of Agriculture in those days. The head of our department was a Commissioner. The Commissioner, Hon. Norman J. Coleman, gave his hearty support to the new work of plant disease studies. He approved a change of name from the Section of Mycology to the Section of Plant Pathology, and he further supported our request for additional funds. Plant pathology had become a fact.

COPPER AS A FUNGICIDE

The discovery in France at about this time that copper could be depended upon as a valuable fungicidal agent opened a wide field for practical work in the prevention of plant diseases. With the knowledge that many of the diseases were due to attacks of microörganisms, known as fungi, and that these fungi were spread by bodies analogous to seed, remedial measures that would destroy the spores and not injure the host or crop plant were in demand. Here again came one of those accidents that once in a while occur, an accident that changed the whole course of plant pathological work and gave it an impetus and prestige profoundly affecting its future. In southwestern France the American grape-vine mildew was playing havoc with the grape industry. This was in the early eighties and, despite every effort, the disease was spreading. Grape growers in the region had suffered losses from grapes being stolen along the roadways. To stop the pilfering of the fruit, some of the growers hit upon a scheme for sprinkling the vines with a solution of lime and copper sulphate, or blue stone. This gave the foliage a bluish-green appearance and stopped the pilfering of the fruit, for it was believed to be poisoned. Much to the surprise of everyone, and particularly the scientists who were still patiently searching for remedies, the lime-copper mixture checked the mildew on the treated vines, while all others not so treated lost their leaves early in the season from mildew. This, in brief, is the genesis of the celebrated Bordeaux mixture, a fungicide now used through-

out the world and which has been the means of saving millions of dollars.

The newly organized Section of Plant Pathology in the Department of Agriculture early began the use of this and other copper fungicides, and for the next ten years (1887 to 1897), great progress was made in the field of prophylactic treatments. The field was a fascinating one, involving studies in the development of new and improved fungicides or chemical agents for destroying fungi, mechanical appliances for treating the crop plants, and studies of the fungi themselves to determine the best ways, means and times to destroy these parasites without injury to the crops. Our spraying appliances were of the crudest types, and I well recall our efforts to induce manufacturing firms to put on the market some of the devices our workers developed. It was necessary to supply manufacturers with working drawings and in some cases actual patterns in order to arouse their interest in the necessary spray pumps, nozzles and other appliances. I have long looked upon this period as epoch-making in agricultural progress, especially in the science of plant pathology, for the practical results achieved proved beyond question the value of scientific work applied to agricultural practices. It was during this period that some of the most troublesome and destructive pests of our fruit, vegetable and farm crops were mastered and the spraying of farm crops became as much a part of good husbandry as plowing, fertilizing, cultivating and similar practices. It was at this time, furthermore, that the little group of plant pathologists in the federal department began making direct contacts with farmers and fruit growers by what we called demonstration experiments. The fundamental idea here was to induce the fruit grower and the farmer to help himself by doing something he was *shown* how to do and not told how to do.

COÖPERATIVE DEMONSTRATION WORK

Starting in 1887 with less than two dozen grape growers as coöperative demonstrators, three years later we had more than five thousand using the copper remedies for black rot, mildew, anthracnose, and other diseases of the grape. Similar coöpera-

tive demonstration field work was inaugurated with potato growers. This, so far as I know, was one of the first efforts in actual demonstration work in this country and was the beginning of a movement culminating in the Lever Extension Act, through which the federal government and all the states are coöperating to the end of carrying agricultural knowledge by demonstration and other ways to the people on their own farms and in their own orchards. Out of all this has grown the great farm bureau movement, involving the placing of county agents and agricultural advisers in practically every county in the United States.

During the period of which we have been speaking, the state experiment stations were also active in carrying practical results direct to the people so that by the beginning of the present century there was a strong background of public approval supporting plant pathological work. This made it less difficult to secure funds and properly organize for future research. And here again I wish to call attention to what may be called a sort of groundswell of public opinion that had much to do with shaping agricultural progress for the next twenty years Behind this and acting as a constant urge was the steady increase in the cost of living. We can all recall how this question became more and more acute in the years preceding the World War All sorts of opinions prevailed as to the cause of mounting living costs and all sorts of remedies were offered as palliatives. It was the dwellers in cities and towns that felt the pinch of the diminishing pocket-book. Out of all this there crystallized a conviction, not supported by any economic facts, that agriculture was not producing enough. The farm, orchard, garden stock and poultry yard must be speeded up; more scientific farmers must be trained; and funds for agricultural education and especially extension activities must be increased.

PROSPEROUS PERIOD FOR RESEARCH

The federal Department of Agriculture and the state agricultural colleges and experiment stations entered upon a period of unprecedented prosperity and growth, which lasted for nearly fifteen years, from 1900 through 1914. Plant pathology profited

by all this awakened interest in agricultural matters. Departments of plants pathology with full professorships were established in several of the universities and agricultural colleges, while in the Federal Department all the plant work was redirected and brought within a new bureau, the Bureau of Plant Industry. Plant pathology was one of the major lines or work of this bureau.

The state experiment stations were also active and, when increased funds for research were made available for the stations through the passage of the federal Adams Act in May, 1906, plant pathological subjects were brought to the forefront.

One of the best and most dependable methods of gauging public opinion at the time of which we speak was the attitude of Congress toward the many new lines of agricultural work being proposed. Time was when Congress paid very little heed to the farmer and the farmer's needs. But such were the demands for relief from rising living costs that city members were among the most aggressive in demanding that agriculture be supported. For practically this whole period, it fell to my lot to present the needs of the Department before the several Congressional Committees each year. From a pleader for sufficient funds to meet the urgent need of our scientific staff, we were forced to become a sort of censor for numerous projects involving funds that our experts knew we could not wisely use. The period was an epoch-making one in plant pathology because for the first time in our history we had funds enough and problems enough to enter upon some real research without the fear of being hastened or crowded for immediate results. The breeding of disease-resistant crops, necessarily slow and painstaking work, was entered upon with some striking and far-reaching results. Great advances were also made in knowledge of parasite and host relationships and the effect of soil and climate on both, with all the long train of related and interrelated effects. Many obscure plant diseases were brought under control through research which showed how intimately environment was linked with both the crop plant and the organism attacking it. One of the outstanding pieces of

plant pathological work inaugurated during the period in question was that of the late Dr. Erwin F. Smith, who proved beyond doubt that many plant diseases were caused by bacteria. Doctor Smith's work placed the science of plant pathology on a firm footing and gave it a standing and an impetus felt to this day. The science of phytopathology had arrived and it was not long (1909) before the American Society of Phytopathologists was organized with a membership of two hundred or more. It was a year or two later (1912) that demands for protection against alien crop pests became so strong that Congress passed the Plant Quarantine Act. Millions of dollars worth of crops annually were being destroyed by pests introduced from foreign countries, and the aim of the Plant Quarantine Act was to safeguard the country against further pest introductions. The research in phytopathology, conducted largely by workers in the Department of Agriculture and the state experiment stations, provided the foundation for steps taken in plant exclusion and plant quarantines involving crop diseases.

WORLD WAR A TEST OF RESEARCH

And then came the World War which was to prove the acid test for research in many fields. Plant pathology stood the test and emerged strengthened and heartened by its success in aiding the great campaign for increasing food production at a time when every pound of food made or saved meant a step toward victory. During the hectic years of war when every phase of science was concentrated on the food problem, plant pathology's greatest contribution was in the field of preventive measures resulting in the saving of major crops from losses caused by diseases present to a more or less degree every year. The intensive campaign put on for the prevention of cereal diseases, diseases of sweet and white potatoes, diseases of fruit, and diseases of vegetable crops resulted in adding millions of tons of food products to our diminishing supply. All research was stimulated in this period and the effects of this stimulation will doubtless be felt for a long time.

PLANT PATHOLOGY YESTERDAY AND TO-DAY

The picture of plant pathology or phytopathology, as we view it to-day, is very different from the one we may visualize by turning back the pages of time a half or even a quarter of a century. On the one hand we see nothing worthy the name of a science; neither the federal nor state governments were interested and but one or two of our great educational institutions were paying any attention to the subject; crop losses through diseases were accepted as a matter of course, being regarded as part of the toll the husbandman must pay. To-day the picture is strikingly different. A well-defined and recognized science which involves the technique of the biochemist, biophysicist, the bacteriologist and plant physiologist; the federal government supporting the work through annual appropriations aggregating nearly a million dollars, with the states contributing fully as much more; well-organized and conducted nation-wide plant-disease surveys whereby old diseases may be watched and new ones immediately reported, all for the purpose of better methods of control; departments of plant pathology in practically all of our state universities and agricultural colleges, and plant pathology recognized as a major subject in practically all of the forty-eight state experiment stations; plant pathological knowledge broadened and deepened so that many troubles which a few years ago were beyond our ken are beginning to be understood; virus diseases; diseases due to bacteria; diseases in which organisms play no part, and a large number due to malnutrition; to detrimental substances in the soil; to lack of soil drainage or soil aeration and to cold and heat.

THE NEW AGRICULTURE

As we close our brief review of this subject, we feel again impelled to center attention on the great shifting drama of agricultural progress in this country. Plant pathology has been and no doubt will continue to be only a phase of this progress. I believe that one of the great motivating forces which has brought farming to its present state is the growing consciousness that

America must build a new agriculture and that the old-world type will not do for us. I believe further that despite our present much-discussed difficulties we are making progress and that we may look forward with serenity and confidence to an ultimate permanent husbandry freed from the blight of peasantry, a husbandry giving full reward to the farmer and the farmer's family, a reward no more and no less than that meted out to his brother in other fields of industry.

ANCIENT MEDITERRANEAN AGRICULTURE*

PART I

BY ELLEN CHURCHILL SEMPLE†

GEOGRAPHIC CONDITIONS

Ancient Mediterranean agriculture had to adjust itself to a complex group of geographic conditions. It found a simple combination of climate, soil, and relief over a large area only in a few places like Egypt and the Po River Valley. In other districts the combinations were manifold within a small extent of country. Mountains dropped down to plains; a gravel-strewn soil bordered a fertile alluvium; a highland section of heavy rainfall sent down its streams to a semi-arid lowland; a limestone plateau, covered with a thin veneer of earth, overlooked a valley of deep rich soil; rainy winters alternated with long periods of summer drought, and the amount of the rainfall was unreliable. Agriculture was stimulated by the necessity of adjusting itself to these varied geographic conditions, and hence attained a precocious development which in many respects anticipated the best modern achievements.

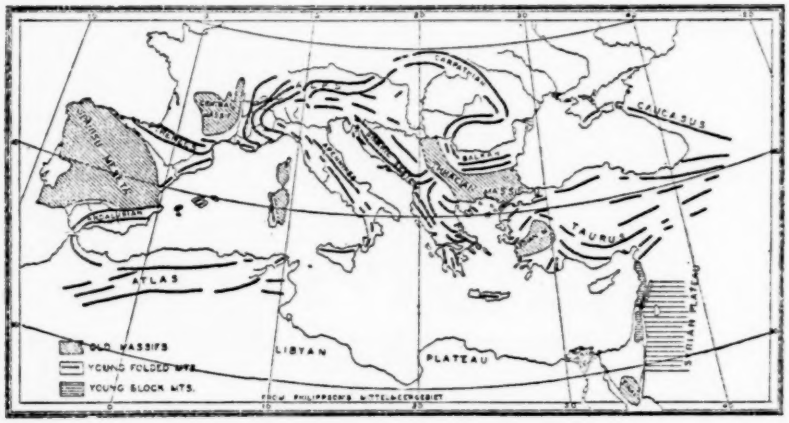
MOUNTAIN RELIEF

Owing to the prevailing mountain relief, the Mediterranean countries suffered from a paucity of level land adapted

* This article is divided into two parts. Part I, as here printed, was read at a joint meeting of the Agricultural History Society with the American Historical Association, December 28, 1927. Part II will appear in the next number of *Agricultural History*.

† Ellen Churchill Semple, widely known because of her work in anthropo-geography is the author of a number of scientific articles in geographical journals and also of two books, *American History and Its Geographic Conditions* (1903) and *Influences of Geographic Environment* (1911). She has served on the faculties of the University of Chicago and Clark University.

to tillage (see Map No. 1). Young folded systems with steep slopes, narrow valleys, and eroded canyons alternated here and there with old highlands of gentler slope. Coastal plains and interior lowlands were small and rare. Nearly the whole region was broken up into a series of narrow valleys opening out into deltaic flats, enclosed on three sides by hills or mountains. These were the garden spots of the Mediterranean. Here population concentrated, living off the produce of the small but fertile area, and securing its luxuries by sea-borne commerce. But population early



Map No. 1. Mountain Relief—Mediterranean Basin

outstripped the local means of subsistance. The home fields were compelled to produce more by improved methods of cultivation. Mountain-sides were terraced to extend the arable area. Retaining walls protected the new-made fields from erosion, and constant manuring kept up the fertility of these shallow shelves of land. On the durable valley fields every method was applied to increase the yield; repeated fertilization of the soil, careful tillage, intelligent selection of crops suited to climate and soil, importation of foreign seed and foreign plants, painstaking seed selection, all combined to constitute a precocious form of intensive tillage.

CLIMATE

Climate also was a potent factor in speeding up improved agricultural methods. The Mediterranean region is approximately a climate unit. It is a region of winter rains and summer droughts, of warm summers and mild winters (see Map No. 2). The annual precipitation as a whole is

MAP NO. 2. ANNUAL RAINFALL—MEDITERRANEAN BASIN

moderate, but it varies greatly from one district to another (see Map No. 3). It declines from north to south, from highland to lowland, and from the west side to the east side of mountains, peninsulas and islands. It ranges from 60 inches or more on the Alpine slope near Trieste to 50 in Corfu, 27 in Patras, 21 at Candia in Crete, and 11 inches at Benghazi on the Cyrenaica coast of Africa.

It declines from 40 inches in Cephalonia on the west side of Greece, where the land lies exposed to the rain-bearing winds, to 16 inches in Athens 170 miles away on the eastern side but located in the rain-shadow of the Pindus Mountains; and it increases again to 26 inches in Smyrna on the west coast of Asia Minor.

MAP NO. 3. SUMMER RAINFALL—MEDITERRANEAN BASIN

It is not the amount of the rainfall, however, but its marked seasonal distribution which characterizes the Mediterranean climate; and no appreciable change in this climate has occurred, in historical times, according to the evidence. The Mediterranean maritime region, however, includes several divergent climatic provinces. The Aegean and Black Sea give access to the Scythian plains (Russia) which get their rains (12 to 18 inches) chiefly in spring and

early summer in time for the spring wheat crop. The Po Valley, owing to its northern location and encircling mountains, gets its heaviest rains in autumn and spring, with showers through the summer. Egypt is a land apart, a fluvial oasis stretched across the African desert, innocent of rain beyond the Nile delta.

The Mediterranean climate, by reason of its sub-tropical temperatures, winter rains, and summer droughts, caused winter to become the chief season of tillage, and summer a period of relative rest. For the sown crops of winter, which were aided by the mild winter temperatures, the rains usually sufficed; but owing to the variability of the annual precipitation and to the uncertain duration and intensity of the long summer drought, the Mediterranean peasant had to adjust his tillage to the constant threat of inadequate rainfall. Hence he resorted to dry farming methods, which involved an alternate year of crop and fallow, elaborate plowing and working both of the fallow and the crop land, and careful discrimination in the use of soils, those which were dry and those which were retentive of moisture. The method of soil improvement resulting from this pressure of climatic conditions was a form of intensive agriculture.

The summer drought, which increased in length and intensity from north to south and from west to east in the long elipse of the Mediterranean lands, necessitated irrigation for the cultivation of summer crops. These included many legumes, all vegetables, and also monsoon fruits which, in the course of time, were imported from the Orient and which required for their growth both heat and moisture. Irrigated tillage was also a form of intensive agriculture. It involved an expenditure of labor and capital in the construction of reservoirs and conduits; it necessitated frequent manuring of the irrigated fields which could be cropped all the year round; and it encouraged careful selection of seeds and plants in order to secure a fair return upon the valuable irrigated land. The mild winter temperatures of the Mediterranean region provided a long growing season which

repaid tillage and therefore was an incentive to increased effort. The only definitive checks upon the crops which might be raised were the amount of rain or available irrigation water and the quality of the soil.

SOILS

The ancient farmers recognized the importance of soils and distinguished many varieties. Interest in the quality of soil meets us in the earliest Greek literature. Odysseus, in the Isle of the Cyclops, observes that "the land might yield a very heavy crop and one always in season, for the subsoil is rich."[1] Homer in the *Iliad* speaks of "deep-soiled Troyland," "deep-soiled Thrace," "deep-soiled Phthia," and "goodly Elis,"[2]—a broad plain of loose Tertiary materials, overlayed by alluvium washed down from the Arcadian Highland. He knows "the fresh-ploughed field of rich tilth and wide," where "the upturned soil shows black."[3] One would have enjoyed touring Greece with that observant poet before the light of his eyes went out. Herodotus sweeps Egyptian land with the discerning glance of a farmer; he describes the soil of the Nile flood plain as "black and crumbling as if it were mud and alluvial deposit, brought down by the river from Ethiopia; whereas we know that the earth of Libya is reddish and somewhat more sandy, and that of Arabia and Syria is more clayey and flinty."[4] Libya and Arabia defined respectively the western and eastern borders of the Nile flood-plain, which alone constituted the Egypt of his time.

The ancients judged the fertility of soil by its color, according as it was black, dark, red, grey, or white; by its texture as fat or lean, heavy or light, dense and sticky or loose, compact or friable, gravelly, chalky or sandy, loamy or clayey; by its water content as wet, miry, moist, dry and

[1] *Odyssey*, IX, 136.
[2] *Iliad*, III, 73; XX, 485; IX, 328; XI, 685, 697.
[3] *Iliad*, XVIII, 541–548.
[4] Herodotus, II, 12.

parched; and finally by its natural vegetation.[5] They recognized various combinations of these qualities, as light loose, warm soil or cold, dense, clayey soil or deep, rich, friable soil. At an early date they appreciated the value of mixed soils, in regard not only to fertility but also to mechanical composition. Theophrastus apparently questioning many of the two thousand students who attended his lectures in the Lyceum of Athens, summarized the agricultural practice which they had observed in their widely scattered native localities. "They tell us to mix contrasted kinds of soils, heavy with light and light with heavy; thin soil with rich, and also the red (*terra rubra*) with the white; and all contrasted kinds with rich soil. For the mixture not only remedies defects, but also adds strength, no matter what kind it was. If you will mix with another soil that which is exhausted and unsuited to grains, it will bear again as if renewed."[6]

The ancients distinguished soils also by their location in valleys, at the base of mountains, or on the middle or upper slopes;[7] they recognized the relation of fertility and soil depth to the terrain, and therefore gave more manure to hillside fields than to valley land.[8] Moreover, they sowed thickly or scantily according to the quality of the soil.[9] "A fat good soil can bear heavier seeding than one which is sandy and light. However, they say that the same piece of land can take up more seed at one time and less at another time."[10] Rainfall, snow, exposure, winds, dew, sun, and especially cultivation were all recognized as affecting the

[5] Xenophon, *Oeconomicus*, XVI, 198; Herodotus, IV, 198; Theophrastus, *Historia Plantarum*, Bk. VIII, chap. ii, 8; chap. vi, 2–6; chap. vii, 5–7; Cato, *De Re Rustica*, 34; Varro, *Rerum Rusticarum*, Bk. I, chap. ix, 2–7; Columella, *De Agri Cultura*, Bk. I, chap. ii, 15; Bk. II, chap. ix; Vergil, *Georgics*, II, 177–258; Pliny, *Historia Naturalis*, XVII, 3, 4.

[6] Theophrastus, *De Causis Plantarum*, III, chap. xx, 3.

[7] Theophrastus, *Historia*, pt. II, chap. v, 7.

[8] Columella, II, chap. v, 1; II, chap. x, 6.

[9] *Leviticus*, XXVII, 16; Xenophon, *Oeconomicus*, XVII, 8–11; Columella, II, 9; Varro, I, chap. xliv, 1; Pliny, XVIII, 55.

[10] Theophrastus, *Historia*, Pt. VIII, chap. vi, 2.

yield of the soil.[11] Xenophon found nothing more profitable than to buy poor neglected farm land, renovate it by judicious cultivation, and sell it at an increased price.[12] Pliny dissented from a current opinion that the land of Italy was worn out, although the deterioration of field agriculture in his time was generally acknowledged.[13] As a matter of fact, these and other soils of the region have shown marked durability and powers of recuperation.

The soils of the Mediterranean region were in general young soils. They were allied in origin for the most part to the black earths of southern Russia. Conditions of climate and relief and the presence of wide-spread limestone formations combined to maintain the youth of these soils. The moderate or meager rainfall characteristic of large parts of the basin and its seasonal distribution tended to reduce the evil of leaching and hence to conserve the humus content of the soil. The limey constituents in the soil contributed to the same end by furnishing abundant supplies of calcium carbonate, which counteracted the natural tendency to acid formation and deflocculation; for a flocculated soil tends to preserve its fertility indefinitely. The limey content was constantly renewed from the underlying rock or it was supplied by the wash of earth on the ever present slopes. Moreover the prevailing mountain relief produced a slow rejuvenation of the soils by the steady transportation of fresh soil materials from the higher to the lower slopes, from mountain to piedmont, and from piedmont to valley or coastal plain. This process was accelerated by the erosive power of the wet weather streams, which carried off waste from the slopes and banks all the more effectively because the earth was baked and cracked by the summer drought.

The Tertiary terraces flanking many Mediterranean highlands consisted of weathered limestone, sandstone, marl,

[11] Theophrastus, *Historia*, Pt. VIII, chap. vii, 2, 6; IV, chap. iii, 7.
[12] Xenophon, *Oeconomicus*, XX, 22-26.
[13] Pliny, XVII, 3.

and clay, veneered with alluvium. They therefore provided successive levels of deep arable soil extending far up the mountains. But numerous slopes of pure Cretaceous or Tertiary limestones were covered with only a thin mantle of earth. These furnished considerable areas of shallow soil, poor and arid, because the rain water percolated through the porous underlying rock; and where precipitation was heavy, as in the karst districts of Italy, Illyria, Greece, Epirus, and the summit of the Judean Plateau, these conditions combined to develop the *terra rossa* or *terra rubra* of the ancients, infertile red clays, from which all alkalies had been leached out and the scant humus content had vanished.[14]

MARITIME INTERCOURSE

Another factor indirectly encouraged ancient Mediterranean tillage. This was the enclosed sea which everywhere opened up avenues of communication and along these Greek and Phoenician colonists and traders carried improved methods of tillage from old cultural centers in the east to the pioneer regons of the west. Agricultural exchanges characterized the maritime commerce from earliest times. Import and export of foodstuffs figured equally in the trade of ancient Palestine and ancient Spain. The result was the practice of propagating new seeds and new plants from oversea lands. It was a trial and error method, but brought about a great diversification in the crops raised.

The ancient farmer learned by experience that climate and soil were big factors in the differentiation of fruits and grains; that a vine stock from Lebanon, for instance, gave a different grape on the slopes of Vesuvius or in the plain of the Rhone Valley. He became an experimental farmer, observing the results of every agricultural venture and drawing his conclusions accordingly. He was weak in theory but strong in practice. His methods were warranted to produce results, his result, the best yield possible for his particular

[14] Glinka, *Typen der Bodenbildung* (Berlin, 1914), 62–68.

type of climate and of soil. Hence he watched his neighbors' crops and was guided by their experience.[15] In our common parlance, he was a good "dirt farmer."

ANCIENT LAND UTILIZATION

Conditions of climate and relief gave rise to an elaborate system of land utilization. Plains were used for grain, hills for vineyards and orchards, mountains for forests and summer pasturage.[16] Undrained land in deltaic swamps or water-soaked lowlands were reserved for wet meadows, where hay was mown or cattle were grazed in summer.[17] Other undrained fields were planted to asparagus, to osiers and willows which provided material for baskets and wagon bodies.[18] Rich, moist valley lands were reserved for wheat, flax, and cabbage;[19] poor level soils were planted in various legumes which required little nutriment, like snail clover.[20] Red soil or *terra rossa* of the weathered limestone would yield good lupine and lentil crops.[21] All ancient authorities stress the importance of selecting certain soils for certain crops. Limestone or crystalline rock slopes with thin stoney soil, like the hills of Judea and Caria, were suited for figs and olives. They produced small trees but excellent fruit.[22] Mountain-sides of better soil, like volcanic ash overlying tertiary deposits of limestone and clay, were reserved for vineyards, which climbed the southward slopes up to 1000 feet or more, as on Mt. Massicus in Italy and Tmolus in Phrygia.[23]

[15] Xenophon, *Oeconomicus*, XVI, 3; Cato, *De Re Rustica*, VI, 1, 4: Varro, I, chap. xliv, 1.

[16] Varro, I, chap. vi, 2–6; chap. xxiii, 1–4.

[17] Ellen Churchill Semple, "Ancient Mediterranean Stock Raising," *Ann. Ass. Amer. Geog.*, XII (1922), 20–21, 30–31.

[18] Cato, VI, 4; Cato, IX.

[19] Vergil, *Georgics*, II, 203–225; Varro, I, chap. xxiii, 3.

[20] Varro, I, chap. xxiii, 2.

[21] Cato, 34 and 35; Columella, II, 10; Pliny, XVIII, 36.

[22] Theophrastus, *De Causis*, III, chap. vi, 6–8; Vergil, *Georgics*, II, 179–183; Columella, V, chap. x, 9.

[23] *Iliad*, III, 184; Strabo, XIV, 635; Vitruvius, III, 3; Vergil, *Georgics*, II, 97, 143; Pliny, XIV, 8, 9.

The base of a mountain range, where the land was enriched by the wash of the highlands behind, was considered the best site for a farm; here the soil was young and the fields were accessible to irrigation streams from the highlands, while the farm itself was protected from floods by its elevated site. A southward facing piedmont was the best.[24] Here the sun's heat was most effective by reason of insolation and the mountains behind warded off cold winds from the north, while air drainage protected orchards against untimely frosts. This was the general practice in the land utilization system of the ancients, but many exceptions to these rules were caused by local conditions of climate and soil.

SEASON OF TILLAGE

The distribution of rainfall made the mild Mediterranean winter the season of vegetative growth and the dry summer a period of rest, unless irrigation could supply the requisite moisture. Consequently for the ancient farmer, the winter half-year was preeminently the season of work. Most of the ploughing, harrowing, sowing, and planting had to be crowded into the ever shortening days between the autumn equinox and the winter solstice. The summer, after the early harvest in May or June, was the normal season of leisure. Hesiod, writing in the eighth century B.C., advised the Greek peasant to rest during the heat of the dog days and feast.[25] Therefore, ancient Mediterranean farm life, before the introduction of summer irrigated crops, presented a sharp contrast in its season of rural activity to the Tigris and Euphrates basins, where tillage depended upon the river floods caused by the spring and summer melting of the snows in Armenia; and it presented a like contrast to central and northern Europe, where the summer heat determined the season of tillage. But it accorded with Egypt, for the Nile floods, caused by the summer rains in the Highlands of Abyssinia, did not recede till autumn and therefore threw the big crops into the winter.

[24] Cato, I, 3; Varro, I, chap. xii, 1–3.
[25] Hesiod, *Work and Days*, II, 270–284.

FIELD AGRICULTURE CEREALS

The chief cereals of the Mediterranean Basin in antiquity, as today, were barley, wheat, and spelt (*zea, far,* or *ador*).[26] Rye and oats, essentially crops of northwestern Europe, were excluded in general from Mediterranean tillage because the climate was too dry. Rye was known to the ancient Greeks as a crop of Thrace and Macedonia,[27] whose northern location insured a heavier rainfall; and it was raised in the upper Po Valley in a mixed fodder crop.[28] Oats, known as a weed by Vergil, were a fodder crop fifty years later.[29]

Autumn was the sowing season throughout the Mediterranean Basin; it was called "the seed-time" in Greece and Italy. "The yearly cry of the crane from the cloud," winging his way southward, was the sign of approaching winter with its rains, and warned the farmer that all hands "must plough and sow early and late, on wet days and dry, that the grain lands may be full," says Hesiod, and "a bounteous harvest come with the white blossoms of spring."[30] To delay this autumn labor was to invite disaster. On the Roman farm the fall equinox was "the time to urge on the belated ploughs, while the dry soil allows it, while the clouds hang aloft."[31] The later advent of the autumn rains in Greece postponed the date of ploughing and sowing to October, and in Phoenicia and Palestine to November, when the first showers softened the soil preliminary to the heavy rains which began a month later. At the first sign of rain it was customary to "begin and sow the barley fields right into the showery skirts of frost-bound winter."[32] Greater caution had to be exercised with the wheat, which required immediate showers for its germination, but no excess mois-

[26] Pliny, XVIII, 19; R. Gradmann, *Die Getriedebau in Deutschland im römanischen Alterthum* (Jena, 1909), 32–39.

[27] Galen, VI, 514.

[28] Pliny, XVIII, 40.

[29] Vergil, *Georgics*, I, 77; Columella, II, chap. x, 32.

[30] Hesiod, *Work and Days*, 448–450.

[31] Vergil, *Georgics*, I, 213–215.

[32] Vergil, *Georgics*, I, 210–211.

ture; therefore it was sown after the barley, at successive intervals during the autumn to insure at least some yield.[33] In Greece, "all farmers look wistfully to the sky to see when the gods will send rain and allow them to sow." The rural maxim was: "Sow not on dry soil;" and the losses of impatient farmers pointed its moral.[34] In the eastern part of the Mediterranean Basin, where the growing season was short at best, the harvest was reduced or ruined if the autumn showers preceding the rains were tardy, or if the rainy season failed to end in late spring showers, which fortified the crops for their last period of growth. These were "the former and the latter rains" of the Bible for which the Hebrew farmer prayed.[35]

The crops grew quickly through the warm humid autumn, slowly during the winter, but matured rapidly under the increased warmth of spring. "Abundant harvests come with abundant heat" is Vergil's generalization for Italy; and in Greece Hesiod tells the farmer "to gather the ripe grain, when the snail seeks the shade of a leaf to escape the heat of the sun."[36] The harvest fell in May or June, according to the locality, and had ideal conditions of warm, drying weather. The ripe crops were never jeopardized as in lands of summer rains.

Less common was spring wheat or "three-months wheat," so called because it matured in three months after sowing in March. It was grown in Alpine Italy, Thrace, Sicily, southern Euboea and Boeotia, and was known to yield a hard, heavy grain as opposed to the light, soft winter wheat, which however was generally preferred for food.[37] On the Scythian plains of the Black Sea, both kinds were raised: "the hard wheat crops are those of spring, the soft ones those of winter; for soft kinds are exceedingly light" says

[33] Xenophon, *Oeconomicus*, XVII, 4–6; Theophrastus, *Historia*, Pt. VIII, chap. vi, 1; *De Causis*, IV, chap. iv, 7.

[34] Xenophon, *Oeconomicus*, VII, 2.

[35] *Deuteronomy*, XI, 14.

[36] Hesiod, *Work and Days*, II, 260–262.

[37] Columella, II, chap. vi, 38; Pliny, XVIII, 12, 20.

Theophrastus.[38] The spring wheat of Thrace was attributed by the ancients to the severe winters of that northern region, though the lingering spring rains may have been a factor. The heavy Boeotian wheat was doubtless spring-sown, as it is today, on the margin of the Lake Copais basin when the winter flood waters gradually receded and Lake Copais contracted; the rich lacustrine soil and high water table explained the superior quality of the grain.[39]

Millet and panic also were raised in various parts of the Mediterranean lands. As they required both heat and moisture, they found proper conditions in the irrigated fields of the Nile Valley and the Cilician lowland, where they were extensively cultivated.[40] In other districts they were planted at the vernal equinox, throve with a little irrigation, and matured after a short growing season. They were raised on a large scale as summer crops in the Scythian plains, in Campania of Italy, the northern part of the Po Valley and in southern Gaul,—all regions of summer showers or irrigation streams.[41]

LEGUMES

Besides cereals, several minor field crops which could stand the winter cold were planted in autumn and harvested in summer. But in the northern districts of the Basin, where the winters were rather severe but summers showery, and irrigation was easy, these were set out in the spring. Various legumes like lupines, beans, kidney-bean, various peas, chick-pea, vetch and lentils were usually sown in the autumn in Greece and peninsular Italy; but if they missed this seed time for any reason, they might be sown in the spring. Peas and lentils, which could ill endure the cold,

[38] Theophrastus, *Historia*, Pt. VIII, chap. iv, 5–6.

[39] Theophrastus, *De Causis*, IV, chap. ix, 5.

[40] Xenophon, *Anabasis*, I, chap. ii, 3.

[41] Theophrastus, *Historia*, Pt. VIII, 3; *De Causis*, II, 7; Vergil, *Georgics*, I, 216; Columella, II, chap. ix, 17; Pliny, XVIII, 10, 24, 25, 66.

were usually spring sown.[42] Vergil, whose principles of agriculture were reminiscent of his father's farm in the Mincio valley north of the river Po, advocated spring as the best seed time for beans, as frequent summer showers and abundant ground water provided all the moisture necessary, while irrigation was feasible at the critical blossoming time.[43] Sesame, like millet and panic, was a summer crop in both Greece and Italy and all three throve best by irrigation.[44]

Flax, which in time was widely cultivated, required a rich moist soil, which it was known to exhaust.[45] Soil, therefore, was the chief factor in its distribution. It was raised in Egypt for linen from the earliest times; in Palestine before and after the Jewish conquest,[46] where owing to its exhausting effects on the soil, tenants' contracts permitted it to be sown only once in seven years.[47] It flourished in the alluvial plain of the Phasis River in the land of Colchis, where Herodotus surmised that the culture had been introduced by Egyptian colonists.[48] It was known in Homeric Greece only by the imported fiber; later fine crops were grown in the fertile Tertiary plain of Elis,[49] but in general the climate and soil of Greece were too dry.[50] Flax was raised extensively in the Po Valley and the east coast of Spain where it gave rise to a finished linen industry.[51] It was sown in spring in northern Italy and probably in Colchis where summer rains were bountiful; but in autumn in Egypt and other semi-arid lands of the Eastern Mediterranean. The

[42] Theophrastus, *Historia*, Pt. VIII, chap. i, 3–4; chap. vi, 5; Pliny, XVIII, 30, 31, 33, 36, 37.

[43] Vergil, *Georgics*, I, 214–216.

[44] Theophrastus, *Historia*, Pt. VIII, chap. i, 1; chap. vii, 3; Pliny, XVIII, 22.

[45] Theophrastus, *De Causis*, IV, chap. v, 4; Columella, II, chap. x, 17.

[46] *Joshua*, II, 6; *Hosea*, II, 9.

[47] H. Vogelstein, *Die Landwirthschaft in Palastina zur Zeit der Mishnah* (Berlin, 1894), 50.

[48] Strabo, XI, chap. ii, 17; Herodotus, II, 105; IV, 74.

[49] Pausanias, V, chap. v, 2; VI, chap. xxvi, 4.

[50] H. Blummer, *Griechische Privatalterthümer* (Freiburg, 1882), 107–108.

[51] Pliny, XIX, 2.

fiber was used for various grades of linen, and the flaxseed for food both in Greece and Italy.[52]

DRY FARMING

The annual rainfall in most Mediterranean lands usually sufficed for the winter crops, but owing to wide variations in amount and in duration of the rains, tillage early developed dry-farming methods. Records of recurrent drought and famine meet us in the ancient history of Palestine, Syria, Cyprus, Crete, Asia Minor, Greece, Cyrenaica and Italy. These were often due to curtailment of the growing season. Amos makes Jehovah say: "I have withholden the rain from you when there were yet three months to the harvest."[53] This meant cessation of the rains in February and consequent death to the standing grain. Modern precipitation records of Jerusalem tell the same story. The "former rains" may begin any time between October 4th and November 28th, the first date promising a long growing season with timely germination of the seed in a warm soil, and the latter a short season and imperfect germination in ground chilled by winter cold. Moreover, the "latter rains" may cease any time between April 1st and May 27th, the former date meaning imperilled crops and the latter a full harvest. Italy, in 1922, lost so much of her wheat harvest, because the rains stopped early in May before the grain was filled out, that she had to lift the import duty on wheat. The amount of the rainfall is equally unreliable. At Jerusalem it fluctuates between 13 and 43 inches from a mean annual of 26 inches; at Athens, between 4.5 and 22.5 inches from a mean annual of 16 inches; in the Tunisian or Carthaginian district, between 13 and 26 inches from a mean annual of 17.75 inches; at Syracuse between 10 to 43 inches from an average 25 inches.

[52] Thucydides, IV, chap. xxvi, 8; Pliny, XIX, 3.
[53] *Amos*, IV, 7.

PLOUGHED FALLOW

These fluctuations are recognized by modern climatologists as normal phenomena on the margin of the arid belts; and they were taken into account by the ancient farmers. Dry farming methods were developed to a surprising degree, in Palestine and Greece in the 9th century B.C. or even earlier. Fields were regularly allowed to lie fallow in alternate years.[54] The effect was not only to rest the land, but also to accumulate in the soil a whole year's supply of moisture for the next crop. To accomplish this end, the idle field was kept constantly under cultivation; for working the fallow removed weeds and rendered the soil lighter and moister.[55] Three ploughings were considered imperative, and a fourth or even fifth was advocated. Hesiod calls the fallow "the guardian against death and ruin."[56] He mentions "a thrice-ploughed fallow in the fertile land of Crete."[57] Homer frequently mentions "the thrice-ploughed fallow," which seems to have been the early standard.[58] For the thin dry limestone soils of Palestine, the Hebrew Proverbs advise a fourth or mid-winter ploughing: "The sluggard will not plough by reason of the winter; therefore he shall beg in harvest."[59] Besides the three ploughings between spring and fall, Theophrastus advocates winter ploughing for light dry soils in order to enrich and moisten them.[60] Theocritus observes it was the custom in ancient Elis to "sow the seed in fallow land thrice, aye, four times broken by the plough."[61] Italy's best practice was the same: "That field yields best which twice has felt the summer's

[54] Vergil, *Georgics*, I, 71–72; Varro, I, chap. xliv, 3; Pliny, XVIII, 49.
[55] Theophrastus, *De Causis*, III, chap. x, 1; Xenophon, *Oeconomicus*, XVI, 11–15.
[56] Hesiod, *Work and Days*, 464.
[57] Hesiod, *Theogony*, 971.
[58] *Iliad*, XVIII, 542; *Odyssey*, V, 127; *Odyssey*, XIII, 32.
[59] *Proverbs*, XX, 4.
[60] Theophrastus, *De Causis*, III, chap. xx, 2, 6–7; *Historia*, Pt. VIII, 5.
[61] Theocritus, *Idyl 25*.

heat and twice the winter's cold."[62] Pliny advised five ploughings for dense soils; nine were needed to break up the hard clay land of Etruria.[63] The ancients regarded the fallow as a means of accumulating all the resources of the soil, of which water was "the chief aliment."[64] "Fruitful fields in turn now yield to man his yearly bread upon the plains, and now again they pause, and gather back their strength," says Pindar.[65]

The fields destined for fallow were ploughed first in September in time to catch the autumn showers; the second time in mid-winter to make the soil hospitable both to the winter rains and to the frost; the third time in spring before the last showers of the rainy season; and a fourth time in mid-summer.[66] This last ploughing, which was emphasized by all ancient authorities, had the effect of breaking up the surface enough to prevent loss of moisture by capillary attraction; it was rarely followed by harrowing. The standard was a bare, clean fallow. A field overgrown with thorns and weeds proclaimed the owner a slothful man, void of understanding, indulging in "a little sleep, a little slumber, a little folding of the hands to sleep," but destined to bitter poverty.[67] Xenophon urges ploughing in spring and repeatedly during the summer, in order to eradicate weeds and turn up the fallow to the sun.[68]

CHARACTER OF THE PLOUGHING

Ploughing moreover had to be thorough. Theophrastus and Cato considered it the essence of good tillage.[69] The first

[62] Vergil, *Georgics*, I, 42–49; Compare Theophrastus, *De Causis*, Pt. III, chap. xx, 6–7.
[63] Pliny, XVIII, 49; Pliny the Younger, *Letters*, V, 6.
[64] Pliny, XIX, 59; Theophrastus, *Historia*, Pt. IV, chap. iii, 7.
[65] Pindar, *Nemean Odes*, VI, 10–12.
[66] Varro, I, chaps. 29–32.
[67] *Proverbs*, XXIV, 30–34; *Hosea*, X, 12; *Jeremiah*, IV, 3.
[68] Xenophon, *Oeconomicus*, XVI, 12–14.
[69] Cato, 61; Theophrastus, *De Causis*, III, chap. x, 6.

furrows were run in straight lines and others were drawn obliquely across these to level the ridges.[70] A field was considered well ploughed when it was scarcely possible to detect in which direction the share had last gone.[71] Moreover, all clods were regularly broken up with the mattock, rake or hoe,[72] till no harrowing was necessary for the summer fallow or even for the sown field in autumn except to cover the seed, according to most authorities. Varro and Columella advise harrowing only in case of poorly tilled land.[73] On hillsides, furrows were drawn horizontally in order to prevent washing and to hold the moisture for the plant roots.[74]

The depth of the ploughing was determined by the nature of the land. In Syria and Palestine, where the underlying rock came near the surface, the native farmers used small ploughshares which made a shallow furrow, "lest the earth burnt by the sun, refuse a crop."[75] The Greeks appreciated the value of deep culture. It was customary in Megara every five years to dig down deep and turn up the subsoil as far as the water penetrated, because the rain carried the fertile elements down beyond the reach of the roots. The peasants of the rich lake plains of Thessaly had a digging implement called a *mischum* which did the work of a subsoil plough, turning up the earth from a considerable depth.[76] The comment of Ulysses on the subsoil of Sicily suggests that even the Homeric Greeks may have practised deep cultivation. The Romans considered that grain land had to be rich and well tilled for two feet down, not merely on the surface. Hence the fallow was ploughed deep, in order that the roots of the crop might readily penetrate.[77]

[70] Vergil, *Georgics*, I, 9.

[71] Varro, I, 9; Columella, II, 4–5.

[72] *Hosea*, X, 11; *Isaiah*, XXVII, 24–25; Vergil, *Georgics*, I, 164; Varro, I, 29, 2.

[73] Columella, II, 5.

[74] Pliny, XVIII, 49.

[75] Pliny, XVII, 3; Theophrastus, *De Causis*, III, chap. xx, 5.

[76] Theophrastus, *De Causis*, III, chap. xx, 4, 8.

[77] Columella, II, 2, 23.

Deviation from this alternate fallow system was considered permissible only when the winter grain crop was followed by a winter legume crop, which after an early harvest was turned under as a green manure.[78] But this three-field system had to be applied with caution. On a farm of 200 *jugera*, 100 *jugera* were sown in autumn; if a spring crop was raised, it was limited to 30 *jugera* so that nearly half of the land remained fallow. Only very rich, moist, volcanic soils, like those in the Neapolitan district where the ground water was high, were cropped every year.[79]

The fallow system persists in modern Greece. "Grain or fallow" or "grain or forage crop" describes the use of farm land there today, even in the excellent sandy loam of the Marathon plain.[80] In the Peloponnesus, the cropland lies fallow every second or third year, except in a few very fertile districts which are irrigated for gardens and currant plantations.[81]

YIELD PER ACRE

The yield per acre was moderate, despite all efforts at soil improvement through tillage and fertilization. Herodotus and Pliny cite returns of a hundred fold or more, but these were obviously exaggerations. The same applies to the sixty and thirty fold of the Bible, an impossible yield even for the scant sowing practised then as today on the poor soil of the Judean Plateau. According to reliable authorities, the maximum return known in Roman Italy about 50 B.C. was eight to ten fold. This was the yield of winter wheat from rich volcanic soils in eastern Sicily, and it amounted to 20 or 24 bushes to the acre.[82] A yield of

[78] Varro, I, 44; Theophrastus, *Historia*, Pt. VIII, chap. i, 4; *De Causis*, III, chap. xx, 7.

[79] Strabo, V, chap. iv, 3.

[80] Cyrus Hopkins, *Univ. Ill. Agri. Exp. Sta. Bull. 239*, Tables on pages 442, 444, and 456.

[81] A. Philippson, *Der. Peloponnesus* (Berlin, 1892), 540, 561–562.

[82] Cicero, *In Verrem*, III, 47, 116.

fifteen fold or 36 bushels of wheat to the acre was quite extraordinary and restricted to a few favored spots.[83] Old Cato, who a hundred years earlier tilled a farm of average soil in the Sabine hills near Rome, was content with five fold, which meant 10 bushels of wheat or 12 bushels of barley to the acre. This average fell to 8 bushels of wheat or less in the time of Columella (60 A.D.), when field tillage declined in Italy owing to excessive competition of foreign grain.[84]

ORCHARD AND VINEYARD CULTURE

Hardly less important than field agriculture was the orchard and vineyard culture of the ancient Mediterranean world. Every farm normally combined both branches of tillage in order to provide its own bread, olive oil and wine. This was the rule from the earliest times. To the ancient Jews, vineyards and orchards were essential features of sedentary agriculture as opposed to pastoral nomadism.[85] Every son of Israel wanted to sit under his own vine and his own fig tree.[86] Solomon purchased building materials for the Temple with wheat, oil and wine, all products of Palestine.[87] Grain fields, vineyards and orchards characterized the princely estates of the Homeric age in Greece.[88] Each farm, each district was practically self-sufficing.

But as maritime trade developed, as centers of population increased in size and multiplied, natural grain regions like Egypt and the Scythian plains became the dominant sources for bread-stuffs, though every small district and especially inland localities maintained some cereal culture against emergency times of war and piracy, when oversea supplies of grain became unreliable. With the curtailment of home-grown wheat fields, orchard and vineyard culture spread.[89]

[83] Varro, I, 44; Pliny, XVIII, 55.
[84] Columella, III, 3–4.
[85] *Jeremiah*, XXXV, 6–10.
[86] *I Kings*, IV, 25; *Isaiah*, XXXVI, 16.
[87] *II Chronicles*, II, 10, 15.
[88] *Iliad*, XVIII, 564–565; *Odyssey*, XXIV, 241–246; Hesiod, *Work and Days*, II, 250–254.
[89] Suetonius, *Augustus*, 42; *Domitian*, 7.

From the time of Solon, Attica was famous for its olive groves, the only remunerative crop on that poor limestone soil; Lesbos and Chios were noted for their vineyards. In the last decades of the Roman Republic, Italy looked like one great orchard,[90] while its mountains were mantled in vineyards. These branches of tillage yielded a big profit. They increased in regions of dense population or small arable area, where large returns from the soil were imperative. Such were the islands of the Aegean Sea and countless mountain-rimmed valleys, like that of Sparta. Certain localities, adapted by soil and climate to superior varieties of fruit or vine, specialized accordingly.

Ancient farmers made a radical distinction between sown and planted crops.[91] The latter were assigned to the hills, but were developed by close adaptation to conditions of prevailing winds, soil, exposure and air drainage. Their place in the complex system of land utilization was formulated in 313 B.C. by the Greek Theophrastus, but the practice was centuries older. Theophrastus says: "Use your rich soils for grains and thin soils for trees. Grains and all other annuals take the nutriment from the surface soil, which therefore ought not to be thin or of a quality to be quickly exhausted, as happens in a shallow layer of earth. But trees, equipped with long and strong roots, draw their nourishment from the depths. In rich soils, trees run to wood and foliage, but yield little or no fruit. Hence a thin soil is superior from both standpoints; it produces a balanced foliage and fruitage."[92] But this lean hillside soil required constant spadework to render it permeable by the roots, and manuring to provide plant food for the trees.[93]

The olive, fig, and vine, held a conspicuous place in ancient Mediterranean tillage. They seem to have been indigenous throughout the region, as they were equipped by nature to

[90] Varro, I, chap. ii, 6.
[91] Xenophon, *Hellenica*, III, chap. ii, 10; Cicero, *De Re Publica*, V, 2.
[92] Theophrastus, *De Causis*, II, chap. iv, 2–3.
[93] Theophrastus, *Historia*, Pt. II, chap. viii, 1.

withstand the summer drought; but their intensive cultivation, by which wild forms were domesticated and superior varieties were produced, spread from the eastern to the western end of the basin through the distributing agencies of trade and colonization. Vines and olive and fig trees survived the summer drought by reason of their elaborate root systems which penetrated down to the moisture conserved in the deeper layers of soil, and moreover spread out widely to gather in the maximum amount of moisture during the rainy season. The olive figured large in the domestic economy of the ancients. Its oil supplied the place of butter which was excluded by the poor pasturage of the Mediterranean lands, and it furnished the chief ingredient in the unguents and ointments for the skin which the strong dry winds of the Mediterranean summers made a necessity. Bread, oil, wine, figs, and grapes, eaten either fresh or dried as raisins and fig cakes, formed staple articles in the ancient Mediterranean diet. Wine was the universal beverage except for the beer used in Egypt and the mead consumed by the retarded mountaineers of central Spain.[94]

Orchards and vineyards flowered in early spring and produced their fruit in late summer or autumn. In ordinary seasons, they weathered the summer drought without irrigation, but in semi-arid regions or in especially dry years they demanded some artificial watering. Egypt, which is a special province of the Mediterranean region both from the climatic and physiographic standpoint, produced fruit trees and vines only by irrigation.[95]

NURSERY BEDS

Everywhere in the Mediterranean region these plants had to begin their life in nursery beds in order to develop an adequate root system, their prime requirement, before they should be set out in the fields. These nursery beds were

[94] Diodorus Siculus, V, 34.

[95] Xenophon, *Oeconomicus*, XIX, 3–10, Pliny, XVII, 14, 16; Vergil, *Georgics*, II, 348ff.

carefully prepared. Generally a trench was dug two or three feet deep and about as wide; stones or boulders were placed at the bottom for drainage, and covered with soil enriched with the proper kind of manure. The soil of the nursery bed and its exposure both to sun and prevailing winds was similar to that of the field into which the young trees or vines should be transferred,[96] "lest a sudden change of mother estrange the young plant," says Vergil. Shoots selected for propagation were the best varieties which could be found adapted to the local soil and climate.[97] They were irrigated morning and night until they had made a good start, and thereafter they were tended two to five years before being transplanted. Then they were removed with great care and rapidity to avoid mutilation of the roots and to prevent their getting dry.[98] Months or even a year before this important operation, holes were dug in the orchard or vineyard deeper than the trench of the nursery bed in order to facilitate the downward growth of the young roots.[99] Moreover, the young plant was then set out in the field with its south side indicated by a chalk mark, facing south, and its back to the north;[100] because, says Vergil, "So strong is the habit of infancy."[101] Vine stocks and trees set out in a rich plain were placed close together, because the abundant fertility of the soil would support the close planting;[102] but on the thinner soils of hillsides or mountains, they were given more room.[103]

Olive and fig trees were known to have especially wide-spreading roots.[104] For this reason, a law in ancient Attica prohibited a farmer from planting these trees within nine

[96] Cato, 45, 46, 48; Theophrastus, *De Causis*, III, chap. vi.
[97] Theophrastus, *Historia*, Pt. II, chap. v, 1.
[98] Cato, 28, 45.
[99] Mago quoted, Pliny, XVII, 16; Cato, 43; Columella, V, 10.
[100] Theophrastus, *Historia*, Pt. II, chap. v, 1.
[101] Vergil, *Georgics*, II, 272.
[102] Vergil, *Georgics*, II, 274–277.
[103] Theophrastus, *Historia*, Pt. II, chap. v, 6.
[104] Theophrastus, *De Causis*, III, chap. iv, 2; *Historia*, Pt. II, chap. iv, 6; Palladius, IV, 10, 25.

feet of his neighbor's boundary line, lest the roots should encroach upon the next estate.[105] The interval between olive trees in Italy measures from twenty-five to thirty feet according to Cato,[106] but the distance varied elsewhere according to the locality. Mago of Carthage prescribed an interval of seventy-five feet each way between the olive trees, or of forty-five feet where the soil was poor and exposed to winds.[107] This wide spacing undoubtedly reflected the low rainfall—10 to 14 inches—in the coastal plan of Tripolis, a region long famous for its olive groves, and in Mago's time (500 B.C.)[108] already in the Carthaginian sphere of influence. The trees there and also in the Atlas coast valleys were very large, because the oil was rich and ground water high. They were large also and widely spaced in the orchards of the Guadalquivir Valley; but there the interval may have been due to fertile soil and low rainfall, or to leave room for the grain crops regularly sown in the olive groves. The reach of the branches was considered the proper guide for the spacing.[109] The interval between pomegranates and myrtle was at least nine feet, and more for apples, pears, almonds and figs. Declivities required smaller intervals between the trees because the spread of the branches was less.[110] On windy sites it was found advisable to plant the trees close together for protection.

PRUNING

It was a general principle, recognized by Theophrastus and other writers, that barren trees lived longer than fecund ones, and those bearing scant fruit than those yielding much.[111] The cultivation of the orchard, however, aimed at

[105] Plutarch, *Solon*, 23.
[106] Cato, VI, 2.
[107] Mago, quoted, Pliny XVII, 19.
[108] J. P. Mahaffy, "The Work of Mago on Agriculture," *Hermathena*, VII (London, 1890), 29–35.
[109] Pliny, XVII, 17.
[110] Theophrastus, *De Causis*, III, 8.
[111] Theophrastus, *De Causis*, II, chap. xi, 1–3.

production of fruit, and not at the vigor of the tree. To achieve this purpose the ancients developed an elaborate system of pruning, thereby diverting the nutriment of the tree into the fruit. It was usual to keep the tree low and compact, since a tall growth involved waste of nutriment.[112] But in starting the young tree on its life course, climatic conditions forced the consideration of the woody growth until the tree was established. Experience taught that autumn pruning encouraged the vegetative growth and and spring pruning the development of fruit. Hence it was the rule to prune the poor, meagre vine in the autumn and the strong healthy vine in the spring. Moreover, the vine quicksets were cut down almost to the ground at the end of the first year and again at the end of the second year in order to develop roots and to encourage vigorous branching.[113]

The application of this principle meets us in Palestine among the Jews, who probably learned it from the resident Canaanites, a people already advanced in agriculture. The Bible instructs the Jews to plant all kinds of fruit trees but forbad them to eat the fruit of the tree till the fifth year of its growth. For the first three years, the yield was declared unclean; that of the fourth year was sacrificed in the Temple, but that of the fifth might be eaten.[114] The effect of this religious taboo was to discourage all pruning for fruitage and to encourage pruning for tree growth. The experience of American farmers in the interior of Washington teaches that hot, dry summers with intense sunlight stimulate premature fruiting.[115] This evil under similar climatic conditions in ancient Palestine was checked by autumn pruning. But the orchards once established were made to give as large a crop as possible, because of the relative

[112] Theophrastus, *De Causis*, II, chap. xii, 6; *Historia*, Pt. II, chap. vii, 2.

[113] Pliny, XVII, 35.

[114] *Leviticus*, XIX, 23-25; Josephus, *Jewish Antiquities*, IV, chap. viii, 19.

[115] L. H. Bailey, *The Pruning Book* (New York, 1914), 182, 185, 188.

paucity of good arable land and gentle slopes. The Bible forbad the Jews to destroy olive trees in war time, either wantonly or to use the wood in beseiging a city, because they were an asset for the conquerors.[116]

GRAFTING

The chief problem in the ancient Mediterranean orchard was to get the root system of a tree established. Young trees with shallow roots were at a disadvantage unless they were accessible to irrigation streams; but artificial watering often impaired the quality of the fruit. Hence grafting early became a feature of ancient fruit culture. A tree once established with a strong root system, such as wild olive, wild pear or wild apple, could be utilized by a fine grafted shoot.[117] According to Theophrastus, it was thus possible to upset the laws of nature, since the vine-dresser could produce black, white, and red bunches on the same shoot and could develop seedless grapes.[118] Experience also taught the ancients that grafted branches gave a yield true to type, while seedlings tended to revert to the wild variety or bear inferior fruit.[119] Grafting enabled the farmer to render barren trees productive and to introduce superior varieties.

OLIVE ORCHARDS

A large proportion of the orchard land apparently was devoted to olives. This was true in ancient as in modern times.[120] Pliny mentions fifteen varieties of olives, distributed from Syria to central Spain and from the base of the Alps to Africa. Italy raised the best fruit; Istria and

[116] *Deuteronomy*, XX, 19.

[117] Aristotle, *De Plantis*, I, 6; Cato, 40–42, 45; Varro, I, 40; Columella, V, 2, 8.

[118] Columella, *De Arboribus*, IX; Theophrastus, *De Causis*, V, chap. iii, 1.

[119] Theophrastus, *Historia*, Pt. II, chap. ii, 4–6; *De Causis*, II, 24.

[120] For Italy and Spain, *International Year Book of Agricultural Statistics* (Rome, 1922), Tables 38, 39; for Greece, *Report on the Industrial and Economic Situation in Greece* (London, 1927).

the Guadalquivir valley of Spain (Baetica) ranked next. Roman Africa "has been all but deprived of oil and wine," because both climate and soil were better adapted to grain production.[121]

Olive trees throve on a dry calcareous soil like that of Attica or Judea, or on a tenacious clay covering a slope, or on a mixture of clay and sand with a gravelly sub-soil.[122] Drainage was imperative. "Stubborn land and ungracious hills, fields of lean marl and pebbly brushwood welcome the long-lived groves of Pallas Athene," says Vergil,[123] speaking from the standpoint of the Alpine piedmont with its ample rainfall. Cato and Varro, familiar with the dry summers of Latium, advocate a dense warm soil for eight specified varieties of olive trees.[124] In the Guadalquivir Valley, with a fifteen inch rainfall, the orchards needed rich soil to retain moisture; but they yielded an excellent fruit in the Venafrum hill country of Campania, where the soil was gravelly and the rainfall amounted to 30 inches.[125] Hence it was a question of soil in relation to climatic condition. But exposure also came into the problem. The site of the olive grove might vary; but a location near the sea which reduced the frost hazard, and a westward facing slope were always preferable.[126]

Olive orchards required only moderate cultivation, because they were inured to the dry summers. It was necessary to prune, to manure, to plow or dig about the trees each year, and occasionally to bare the surface roots and clean away the suckers.[127] Improved methods of tillage which developed in course of time greatly curtailed the interval between planting the slow-growing orchard and reaping a

[121] Pliny, XV, 3–4.
[122] Columella, V, 8.
[123] Vergil, *Georgics*, II, 177–183.
[124] Cato, 6; Varro, I, chap. xxiv, 1–2; Theophrastus, *Historia*, Pt. II, chap. v, 7.
[125] Pliny, XVII, 3.
[126] Cato, 6; Varro, I, chap. xxiv, 1.
[127] Columella, V, 9, 15.

crop. Hesiod said that a man who planted a olive grove would never live long enough to eat its fruit; but young trees raised for five years in the nursery bed and cultivated after transplanting could be made to yield in seven years. But this was only under the best climatic conditions; in many localities the interval was longer.[128]

FIG ORCHARDS

Figs ranked next to olives as an article of food. They were grouped with bread and oil in the diet of the common people throughout the Mediterranean lands.[129] Cato advised that farm slaves should be fed chiefly on figs from the summer solstice, when the first crop came in, till late autumn.[130] Dried figs were eaten by the country folk all winter in Italy,[131] they were welcome as army rations in ancient Palestine,[132] and once served instead of grain for the forces of Phillip of Macedon in western Asia Minor,[133] doubtless owing to their sugar content.

Fig trees were adapted to a semi-arid climate, owing to their numerous spreading roots[134] and their scant leafage,[135] which lost little moisture by evaporation. They thrived best where the rainfall was light and the summer drought long; they preferred a sunny, well drained site on a hillside and a thin dry soil of weathered limestone or chalk, mingled with gravel or rocks.[136] Hence districts offering these natural conditions raised famous figs,—Caria and Phrygia in southwest Asia Minor where the "Smyrna figs" are raised today,[137] the island of Chios and even Paros with its soil of weathered

[128] Pliny, XV, 1.
[129] *Judges*, IX, 8-13; *Habakkuk*, III, 17; *Odyssey*, XXIV, 243-246; Plutarch, *Lucurgus*, XI.
[130] Cato, 56.
[131] Columella, XII, 14.
[132] *I. Samuel*, XXV, 18.
[133] Polybius, XII, 10.
[134] Theophrastus, *Historia*, Pt. I, chap. vi, 3.
[135] Pliny, XVII, 18.
[136] Columella, V, chap. x, 9; Palladius, IV, 10, 25-26.
[137] E. Banse, *Die Turkei* (Berin, 1916), 143-144.

marble,[138] and Attica which forbad the export of its figs, needing to conserve all its scant home-grown food supply.[139] Theophrastus must have had the infertile land of Attica in mind when he advocated a low or valley site for fig and olive orchard.[140] Italy, which acclimated many imported fig trees, planted one kind in a light chalky soil, and another in a rich or well manured soil.[141] Only the Megarean and Laconian fig were improved by irrigation, which was detrimental to all other kinds.[142] Hence the numerous varieties, twenty-nine in Pliny's time,[143] finally extended the possible selection of fig orchard sites; but lean hillsides held the preference.

CAPRIFICATION

Fig trees yielded their crop in June and again in September. The late fruit hung on the trees all winter to be harvested at will. The failure of the crop was a serious matter. Yet the domestic trees, except the varieties grown in middle Italy, and the Isthmus of Corinth, frequently made a diminished yield owing to the dropping of the immature fruit. A remedy for this evil was assiduously sought, Theophrastus tells us, and was found in caprification. This consisted in attaching to the branches of the domestic trees, which bore only female flowers, the fruit of the wild fig or caprifig, in order that minute gall wasps, *psenes*, which were generated therein, might crawl into the half-developed edible fruit of the domestic fig. The time for the operation was in late June and again in September, when the wild figs contained abundant male flowers with their pollen, and the insects were ready to emerge.[144] This natural process was properly

[138] Athenaeus, III, 6–9.
[139] Plutarch, *Solon*, XXIV.
[140] Theophrastus, *De Causis*, III, chap. vi, 6.
[141] Cato, 8, 1; 40, 1; Varro, I, chap. xliv, 4; Pliny, XV, 19.
[142] Theophrastus, *De Causis*, III, chap. vi, 6.
[143] Pliny, XV, 19.
[144] Aristotle, *De Animalibus*, V, 146; Theophrastus, *Historia*, Pt. II, chap. viii, 1–2, *De Causis*, II, chap. ix, 3, 6–15; Columella, XI, 2, 56.

interpreted by Theophrastus as cross fertilization of the fig fruit by an insect.[145]

The ancient Greeks thus improved upon nature's method, while following nature's example, at a very early date; they had doubtless learned from older cultivators of the fig in Syria and Asia Minor to tie bunches of the wild fruit on the domestic fig tree in order to insure a short journey for the insect to its destination. However, a like purpose was achieved by planting caprifigs in the fig orchards, the early variety near the early, and the late near the late kind, if the wild trees were set out on the windward side of the orchard so that the breezes might aid the flight of the little insects to the domestic trees.[146] This method was less troublesome but also less reliable, especially in late summer when the strong north winds might sweep the insects quite away.[147] These pollen-carriers were necessary to save the figs which were best adapted for drying; and caprification also improved the flavor of the fruit. Hence the insects were made the subject of careful study by the ancients. The *psenes* were found to have an enemy in the *cynipes*. The Greeks discovered a corrective for this state of affairs in *cancri* (literally crabs) which preyed upon the *cynipes* and which therefore were applied to the trees.[148] The *cynipes* and *cancri* have not been certainly identified, but the *psenes* are known to moderns as the *blastophaga grossorum*. They were colonized in California from Caria after Smyrna fig trees were introduced into that state between 1880 and 1890. There, also, the immature fruit dropped until caprification was practised.

PALM CULTURE

A similar method was used to fertilize palm trees and prevent their dropping the immature dates. It consisted in

[145] Theophrastus, *Historia*, Pt. II, chap. viii, 4.

[146] Theophrastus, *De Causis*, II, chap. ix, 5–6.

[147] Aristotle, *De Animalibus*, V, 146; Theophrastus, *Historia*, Pt. II, chap. viii, 1.

[148] Theophrastus, *Historia*, Pt. II, chap. viii, 3.

cutting off the spathe of the male palm and shaking out its pollen over the flower of the female tree. From its resemblance to caprification, this treatment of the palm was called *olynthazein* or "the use of the wild fruit." "In the latter case it was a genuine marriage; in the former, the same result was achieved in a different manner," says Theophrastus, anticipating Darwin by 2165 years.[149]

What the fig and olive were to the northern and eastern coast lands of the Mediterranean, the date palm was to the hot southern rim. It furnished nourishing fruit, cakes, wine, fiber and inferior wood. The Arab saying that the date palm flourishes with its head in fire and its feet in water indicates the conditions for its cultivation: tropical heat, aridity, saline soil, and irrigation. Though the tree grew at certain places on the European coast, it was either sterile or yielded immature dates.[150] The northern limit of its growth in ancient Aegean lands ran through Chios, Delos, Tenos and the southern end of Euboea, where it runs unchanged today.[151] The palm was fecund in Libya, Egypt, Phoenicia, Syria, Cyprus, and Crete; but yielded dates suitable for drying only in the Dead Sea Jordan Valley.[152] This depression, 682 to 1293 feet below sea level in the rain-shadow of the Judean Plateau, insured torrid heat and an arid climate with a scant eight-inch rainfall. Springs breaking out along the step-faults of the Jordan rift provided irrigation water. Hence the excellence and fecundity of the date plantations were unsurpassed, and made Jericho famous as "the city of the palms."[153]

VINEYARDS

The culture of the vine presented many problems of adjustment to geographic conditions. Maturing its fruit

[149] Theophrastus, *Historia*, Pt. II, chap. viii, 4; *De Causis*, III, 18, 1; Pliny, XIII, 7.

[150] Theophrastus, *Historia*, Pt. III, chap. iii, 5; Pliny, XIII, 6.

[151] Naumann and Partsch, *Physikalische Geographie von Griechenland* (Breslau, 1885), 410–411.

[152] Pliny, XIII, 6; Theophrastus, *Historia*, Pt. II, chap. vi, 2, 5, 8, 9.

[153] *Deuteronomy*, XXXIV, 3; *Judges*, I, 16; III, 13; Pliny, V, 15.

in August and September, it had to run the gauntlet of the dry summer months. Vineyards were planted on low moist ground in the semi-arid districts like Attica,[154] but on fertile slopes of hills and mountains in the better water parts of the region.[155] There was a choice also in the exposure. Most authorities advise a southerly aspect for the vineyards. Vergil condemns a western exposure,[156] but in some localities it was preferred to an easterly one. In northern sections, as in the Po Valley, another motive came into play owing to possible frosts. There vineyards regularly faced north or northeast; this exposure proved advantageous,[157] doubtless because the blossoming was retarded beyond the frost limit. Some planters selected the exposure according to the humidity of the locality. In a dry section, they faced the vineyard east or north to conserve the moisture in the plants, but in a humid region they planted the vineyard on a southward slope. Vines and trees to which dews were injurious were given an eastern exposure, that the sun might quickly evaporate the moisture; but those helped by the dew were made to face west or north in order to retain the precious moisture as long as possible.[158]

TRAINING OF VINES

The training of vines also was adjusted to climatic conditions. Where the ground moisture was abundant or where rare showers relieved the summer drought, vines were grown on posts or trellis or they were festooned from tree to tree in an *arbusta*.[159] The latter method of training was found chiefly in northern regions like Latium, Etruria, the Po Valley, and western and northern Hellas, where exposure

[154] Theophrastus, *Historia*, Pt. II, chap. v, 7.

[155] *Isaiah*, V, 1–2; *Jeremiah*, XXXI, 5; Vergil, *Georgics*, II, 36–37, 184–194.

[156] Vergil, *Georgics*, II, 298, 357.

[157] Pliny, XVII, 2.

[158] Pliny, XVII, 3.

[159] *Iliad*, XVIII, 564–565; Varro, I, chap. viii, 3, 5; Pliny, XIV, 3; XVIII, 35.

to the winds did not dry out the moisture of the plants. In arid regions like Africa, southern Spain, Sicily, southern Greece, Palestine, Syria, and parts of Asia Minor, the vines were allowed to trail on the ground, and only the grape-bearing shoots were supported by short forked sticks.[160] The advantage was obvious. Plants spreading out over the field presented the greatest possible surface to the heavy dews of high slopes; owing to their low position they were little exposed to the desiccating summer winds, and their foliage shaded the soil about their roots. This was the method of planting in ancient times and it may be seen today in such districts.

The vines suffered, however, from the depredations of field mice and foxes, "the little foxes that spoil the vines" mentioned in the Song of Solomon.[161] Varro said that in the island of Pantellaria each vine thus planted needed a mouse trap and a fox trap.[162] Aesop who wrote the fable of the Fox and the Sour Grapes lived in Phrygia in the sixth century B.C. He was accustomed to the ground-grown vineyards of southern Asia Minor and also to grape-eating foxes. Therefore the thirsty marauder of the fable was disappointed when he came upon a trellis vine, doubtless a novelty introduced by Greek colonists from northern Hellas; for the fox expected to find the grapes lying on the ground within his reach. Theocritus in one of his Sicilian idyls gives us a charming description of such a vineyard.[163] It is twilight. A little lad sits on the rough wall guarding the vines, which are laden with fire-red clusters; for it is summer when the springs have dried up and wild animals are thirsty. Below him two foxes are skulking; one goes along the fine vine rows to devour the juicy grapes, and the other is eating the lunch in the wallet which the boy has dropped on the ground at his feet. For the little lad, perched on the vineyard wall, is absorbed in plaiting a pretty

[160] Varro, I, chap. viii, 1, 5–7.
[161] *Canticles*, II, 15.
[162] Varro, I, chap. viii, 5.
[163] Theocritus, *Idyl I;* compare *Idyl V*.

locust cage from stalks of asphodel; and less care of his wallet has he, and of the vines he was sent to guard, than delight in his interesting task.

Vineyards were allowed to sprawl on the ground also in Liguria on the slopes of the Apennines and on the Mediterranean coast of the Rhone lowland; but the climatic reason here was different. The low situation was a protection against the fierce *mistral* or Circius wind, which swept down from the heights of the Cevennes Plateau with irresistible violence.[164] This method of planting may be seen in Languedoc and Berry today, where the vine rows are generally protected also by a wind-break of cypress trees. The severe summer winds of north Africa provided an additional reason for the ground planting there. Moreover the shoots were pruned away above the first branches and the vine stock thus kept low.[165] This ground planting had the further advantage of economy, because it avoided the cost of props and trellis. Altogether, differences in soil, climate and location, determined the method of cultivation. Wherever the soil was damp, the vine was by preference grown high, for the grapes when forming needed plenty of sun and the vine shoots by natural inclination climbed up the highest trees, where they were supposed to yield the finest juice.[166]

VINE-DRESSING

The vine-dresser also helped to conserve the moisture in the vine. He ploughed deep and cut away the surface roots of the plant in early spring in order to force the development of the lower roots running down to the underground moisture.[167] He pruned also to throw the strength into a few shoots and increase the yield of fruit,[168] but in so doing he also reduced the surface of evaporation. The same end was

[164] Pliny, XVII, 2.
[165] Pliny, XIV, 3.
[166] Varro I, chap. viii, 7.
[167] Columella, II, 2.
[168] Theophrastus, *Historia*, Pt. II, chap. vii, 2.

accomplished also by the habit of thinning out the leaves as the summer advanced and the vintage approached.[169] The remaining leaves in time shriveled in the dry heat and ceased their function of transpiration; but even this was not enough. At the end of August, when the summer's heat and drought reached their maximum, and evaporation was most intense, the soil of the vineyard was regularly reduced to a powder; the dust was tossed up into the air and allowed to settle all over the vines as a protection against the sun.[170] This process, which was called *pulveratio*, checked evaporation from the grapes, leaves, and from the earth about the roots, by preventing capillary attraction of the underground water. This same method was applied in Megara during the September heat to cucumber and squash plants. The fruits were made far sweeter and more tender by this natural conservation of moisture than by the alternative measure of irrigation.[171] In the hot regions of north Africa and southern Spain the vine-dressers covered the grapes with straw to protect them from sun and wind. On the other hand, in northern parts of the Mediterranean region, where the vintage came late and the grapes were occasionally caught by the September showers, the vine-dressers stripped the leaves from the vine to expose the grapes to the intermittent sunshine, and thus hastened their ripening, lest they should rot on the vines.[172]

DRY FARMING IN VINEYARDS

The cultivation of the ancient Mediterranean vineyards represented a thorough system of dry farming, designed to conserve the moisture in the soil and in the plant during the whole period of growth. This involved constant hoe and

[169] Xenopon, *Oeconomicus*, XIX, 18; Vergil, *Georgics*, II, 400.

[170] Theophrastus, *Historia*, Pt. II, chap. vii, 5; *De Causis*, III, chap. xvi, 3; Columella, IV, 28, 1; XI, 2, 60.

[171] Theophrastus, *Historia*, Pt. II, chap. vii, 5.

[172] Columella, XI, chap. ii, 61.

spade work during spring and summer.[173] Vergil's instructions required unremitting labor in the vineyards frequent plowings, banking up the earth repeatedly against the vine stalks, loosening the soils "thrice and again," breaking up the earth with hoe or mattock, "wheeling the steaming oxen between the vineyard rows."[174] That nothing might interfere with constant cultivation, all authorities from the Vergil advised against the planting of other crops between the vine rows. A system of clean culture was necessary. "Thou shalt not sow thy vineyard with divers seed, lest the fruit of the vineyard be defiled," says the author of *Deuteronomy*.[175] The purpose of this injunction was to facilitate constant cultivation of the vineyard soil, and to let the vine absorb all the moisture and nourishment in the ground. Columella sanctioned only the interculture of a short-lived green-manure crop, to be ploughed in.[176] A cover crop of legumes is common today in vineyards in Mediterranean regions which command sufficient water for irrigation; more common is a companion crop (*culture intercalaire*), planted for its own sake, which in Italy greatly reduces the yield of the vineyards.[177]

The ancients considered viticulture one of the most profitable branches of husbandry.[178] The yield of the vineyards seems to support this opinion. Some parts of Italy yielded 300 amphora of wine to the *jugerum* or 3100 gallons to the acre, equivalent to 19,000 bottles. This was the return in the Faventia district at the northern base of the Apennines near Bologna. The Ager Gallicus on the Adriatic coast of Umbria yielded 200 amphora to the *jugerum* or 2000 gallons to the acre.[179]

[173] *Isaiah*, V, 6; Hesiod, *Work and Days*, II, 250–254; *Odyssey*, XXIV, 224–226; Cato, 33.

[174] Vergil, *Georgics*, II, 398–400.

[175] *Deuteronomy*, XX, 9.

[176] Columella, XI, chap. ii, 60.

[177] *International Yearbook of Agricultural Statistics* (Rome, 1922), Tables 34 and 37

[178] Columella, III, 3.

[179] Varro, I, chap. ii, 7.

It was the wine-making connected with the vineyard culture which gave the large profit. Hence this twin industry was highly developed on small mountainous islands and peninsulas, and there it produced famous wines. Some of the best wines of the Grecian world came from Chios, Melos, Lesbos, Thasos, Ikaros, Andros, Naxos, Peparetos, Cyprus, and the Cnidos peninsula. All these islands had a large export trade.[180] In Italy the famous Falernian wine grew on the southward facing slopes at Mt. Massicus, where a thick soil of weathered volcanic rock overlay limestone strata. Vesuvius and Aetna, the Alban Mountains, and other volcanic districts produced superior wines.[181]

The earliest wine of great celebrity, lauded in the *Odyssey*, came from vineyards on the seaward slope of the Ismarus range, which traces the southern coast of Thrace. It was red and "honey-sweet" with a fine bouquet, and so strong that it had to be diluted with twenty parts of water.[182] This same district in Pliny's time produced a wine that could stand dilution with eighty times its volume of water.[183] Phoenician seamen, half traders, half pirates, put into the ports of Homeric Greece and sold choice wines from vineyards spread like a carpet over the Mediterranean slope of the Lebanon Mountains. These were the solace of the tired farmer, as Hesiod sings their praise. "At the height of summer when the grasshopper sounds his shrill note, when the heat is greatest and the skin is parched and dry, under a shady ledge of rock with a bowl of Byblian wine, three-fourths water, let me rest by an ever-flowing spring."[184]

[180] Pliny, XIV, 4, 9.
[181] Strabo, V, chap. iii, 1; chap. iv, 3; XIII, chap. iv, 11.
[182] *Odyssey*, IX, 208.
[183] Pliny, XIV, 6.
[184] Hesiod, *Work and Days*, 582-595.

THE AGRICULTURAL MUSEUM; AN EARLY AMERICAN AGRICULTURAL PERIODICAL

By Claribel R. Barnett

Librarian, United States Department of Agriculture

In the references to the history of the agricultural literature of the United States, *The American Farmer*, the first number of which was published in Baltimore on April 2, 1819, is quite generally given the honor of being the first agricultural periodical published in the United States. It is without doubt rightfully considered the great precursor of our present agricultural periodical press, but there was another little known agricultural periodical which actually preceded *The American Farmer* by nearly nine years and which, it is believed, is entitled to the distinction of being the first agricultural journal published in this country. The name of it was *The Agricultural Museum*, and the first number appeared on July 4, 1810. Its place of publication was Georgetown in the District of Columbia, or "Georgetown, Ca." as it is given on the publication. It was printed by W. A. Rind. The editor of the periodical was Rev. David Wiley. The brief references to Wiley which it has been possible to find[1] indicate that he graduated with distinction from Princeton in 1788, that he was a tutor at Hampden Sidney College, Virginia, from November, 1788 to May, 1790,[2] a Presbyterian minister in charge of the Spring Creek and Cedar Creek Churches, Pennsylvania,

[1] Rev. T. B. Balch, *Reminiscences of Georgetown, D. C.* (Washington, D. C., 1859), 17; *Records of the Columbia Historical Society*, XV (1912), 80–81 (in an article on the Rev. Stephen Bloomer Balch by Allen C. Clark); W. B. Bryan, *History of the National Capital*, I, 596–597; Samuel D. Alexander, *Princeton College during the Eighteenth Century*, 242.

[2] Letter to the author from A. G. Morrison, Hampden Sidney, Va., August 12, 1916.

from 1794 through 1801, and that he came to Georgetown from Northumberland on the Susquehanna about 1802. He was called there by Dr. Stephen Bloomer Balch, a pioneer Presbyterian minister of Georgetown, D. C. Dr. Balch was also the principal of the Columbian Academy of Georgetown. His pastoral and educational duties having become too heavy for him, he induced the Rev. Mr. Wiley to become his successor as principal of the Columbian Academy. The Rev. Mr. Wiley became the librarian as well as the principal of the Academy. He was apparently more interested in science than in teaching for "he did not seem to care whether the school kept or not, when he went surveying."[3] His duties as librarian also did not weigh very heavily upon him. It is said that under his regime "the books were scattered and never regathered, for the principal and librarian had more than even his mighty mind could manipulate successfully."[3] This is not to be wondered at, for he was at the same time "the superintendent of a turnpike, the postmaster, a merchant, a miller, a preacher, the editor of an agricultural paper, and the secretary of an agricultural society."[3] Finally, he was a successful politician, having been made mayor of Georgetown in 1811, the year after he started *The Agricultural Museum.* His activities indicate that he was a man of great public spirit and energy, and of remarkable versatility. He died in North Carolina in 1813 when on a survey in the employment of the Government.

The agricultural society for which Rev. Mr. Wiley served as secretary was the "Columbian Agricultural Society for the Promotion of Rural and Domestic Economy."[4] He evidently intended that *The Agricultural Museum* should be considered to a certain extent the organ of the

[3] *Records of the Columbia Historical Society,* XV (1912), 80–81.

[4] For an account of the Columbia Agricultural Society, see Ben: Perley Poore, "History of the Agriculture of the United States," *Report of the Commissioner of Agriculture for the year 1866* (Washington, D. C., 1867), 518–522.

Society for in the preface of the first number he writes as follows:

"The design of the Editor is to make the Agricultural Museum a repository of valuable information to the Farmer and Manufacturer and the means of a free communication of sentiment, and general interchange of ideas on the important subjects of their occupations. In this view it will be a convenient appendage to the Columbian Agricultural Society. The Constitution and proceedings of that Institution, and especially the premiums proposed and awarded at its general meetings, will be prominent articles. The proceedings of other similar societies in the United States, and elsewhere, will be noticed. Pains will be taken to make the best selections from the most approved Authors, Journalists and Periodical Works. Original Essays and other communications on Agriculture, on Domestic Manufactures, on the Arts, and on the productions and resources of our country in general, will be received with gratitude and attention."

The price of the subscription for "*The Agricultural Museum* was $2.50 for twenty-four numbers, to be paid in advance." That the editor was a man of courage and faith in his own convictions, is shown by the opening paragraph of the first number which reads as follows:

"In presenting the public with the first number of 'The Agricultural Museum,' without having previously solicited or obtained a single subscriber, it may be supposed that the Editor has calculated too largely on the liberality of his friends and fellow citizens. It may be so. Still, however, he would not be discouraged. This has not been the principal source on which he has relied for support. His dependence is rather on the advantages which such a Publication promises to the community than on their liberality."

It is probable that the paper never attained a very large circulation or otherwise it would be better known and files of it would not be so rare. How long it ran is uncertain. The following numbers are contained in the U. S. Department of Agriculture Library: Vol. 1–2, no. 11, July, 1810–May, 1812. It is doubtful whether any numbers were issued subsequent to vol. 2, no. 11. The first volume was issued semi-monthly but beginning with vol. 2 it was issued only monthly. While it was made up quite largely of extracts from proceedings of agricultural societies in this country and abroad and agricultural items from newspapers, it did

contain considerable material written especially for it. One of the short communications of interest was a letter addressed to the editor from Joel Barlow, dated Washington, July 19, 1811, in which he says: "I send you herewith, to be distributed to some of the agricultural members of our Society, small parcels of several sorts of grain, as described below, which I believe to be new in this country." He then described the grains which were Mammoth Rye, Caspian Wheat, and Persian Barley. In conclusion he says: "I hope these several grains in another year may recover their size and fulness, and that some at least of our climates within the range I have sent them, from Massachusetts to Virginia, may prove congenial to them. In which case, we shall find them a valuable acquisition to our agriculture." There were also published in *The Agricultural Museum* several papers which were prepared for local societies in this country. One of the most interesting of these was a paper by Col. John Taylor, of Caroline, Virginia, giving "An account of a new variety of wheat discovered in Virginia, communicated to the Culpepper Society for the Promotion of Agriculture and Domestic Manufactures." This appeared in the number for September 12, 1810.

In one respect *The Agricultural Museum* differed greatly from the agricultural periodicals of the present time, in that it contained no advertisements. It was also quite different in size, for it was a small octavo, not a folio, as the majority of agricultural papers are today. Each number contained 32 pages. As complete files of the paper are rare, the writer would be glad to know of any library which has a complete or partial set.

NEWS NOTES AND COMMENTS

THE ELEVENTH ANNUAL MEETING OF THE AGRICULTURAL HISTORY SOCIETY

Twenty-seven were present at the eleventh annual business meeting and dinner of the Agricultural History Society which was held at the Cosmos Club, Washington, D.C., on April 10, 1928. Rodney H. True, president of the Society, presided. The Nominating Committee, consisting of Nils A. Olsen (Chairman), E. E. Dale, Solon J. Buck, and E. G. Swem, having mailed ballots to members of the Society, reported the following unanimously elected for the year 1928–29: for president, Joseph Schafer, Secretary, Wisconsin State Historical Society, Madison, Wisconsin; for vice-president, F. D. Farrell, President, Kansas State Agricultural College, Manhattan, Kansas; for secretary-treasurer, O. C. Stine, Bureau of Agricultural Economics, U. S. Department of Agriculture; for elected members of the executive committee, A. O. Craven, University of Illinois, Urbana, Ill., and C. R. Ball, Bureau of Plant Industry, U. S. Department of Agriculture.

Two interesting papers were read, one by Edmund C. Burnett of the Carnegie Institution of Washington, D. C., entitled "The Continental Congress and Agricultural Supplies," and one by Rodney H. True of the University of Pennsylvania, "The Work of John Beale Bordley."

Discussion on the possibility and the value of a national agricultural museum which would show the evolution of agriculture in the United States indicated that there is considerable interest among the members of the Society in such a project. F. L. Lewton of the Smithsonian Institution explained how the agricultural models, now stored in the

National Museum, and in the Bureau of Public Roads, were salvaged and selected from the Patent Office collection of models when it was ordered disposed of several years ago. A committee, consisting of F. L. Lewton, H. A. Kellar of the McCormick Library in Chicago, and L. C. Corbett of the U. S. Department of Agriculture, was appointed and authorized to take any action it deemed necessary in case disposition of these models which constitute a nucleus for a collection for an agricultural museum is undertaken.

SECRETARY-TREASURER'S STATEMENT OF RECEIPTS AND EXPENDITURES

September 13, 1927– April 10, 1928.

Received from H. A. Kellar, former Sec.-Treas	$570.13
Annual dues for 1928	35.00
Dues from new members for 1928	56.00
Interest received	6.00
	$647.13

Printing AGRICULTURAL HISTORY JOURNAL for July, 1927.	$128.69	
Large envelopes (500) for mailing January and July issues	4.50	
Mailing AGRICULTURAL HISTORY JOURNAL for July and express on same from Baltimore	5.50	
Membership cards for securing subscriptions	8.43	
Notices of September meeting and ballot (mimeographed)	5.60	
Programs for joint meeting with American Historical Association	9.55	
Mailing programs for joint meeting	3.50	
Telegrams sent concerning meetings, journal, etc	5.85	
Multigraphing of circular letters sent to libraries (200) with two enclosures (price list and list of publications)	15.30	
Letter head Agricultural History Society (250 sheets)	2.75	
Mailing circular letters to libraries	4.00	
Envelopes for mailing notices of meeting and circular letters	3.00	
Express on January JOURNAL from Richmond, Va	1.86	
Draying charges on old volumes sent in by Mr. Kellar	.50	

Stationery and stamps for current letters and copies of JOURNAL sent to new subscribers	$5.00	
Mailing notices of April meeting	3.00	
Bills paid		$207.03
Purchase of 1st Trust Note $200.00 bearing interest at 6 per cent		203.57
Total expenditures		$410.60
Balance in checking account		236.53
Balance in Treasury		$436.53
Bills outstanding: Printing of January issue of JOURNAL		$100.00
New members since publication of January issue of JOURNAL		20
New members since annual meeting in September		35
Resignations since last annual meeting		3
Total membership (April 10, 1928)		218

O. C. STINE,
Secretary-Treasurer.

PERSONAL

Prof. Earl Dudley Ross of the department of history and government of the Iowa State College of Agriculture and Mechanical Arts is making an interesting series of studies of the agricultural interests and policies of great American public leaders. His study of this phase of Theodore Roosevelt's activities appeared in the December, 1927, number of the *Mississippi Valley Historical Review*. At the April meeting of the Mississippi Valley Historical Association, Prof. Ross presented a portion of a similar study of Benjamin Franklin. He also has well under way an interpretation of this phrase of Lincoln's work. Other leaders for whom similar studies are planned are Washington, Calhoun, Clay, Webster, Jefferson, Jackson, Greeley, Bryan and Wilson. Prof. Ross expects to continue his research on the dairy industry and to publish at a later date a study of the development of dairying in the middle west, with especial reference to Iowa.

COMMENTS ON BOOKS AND ARTICLES

Mrs. Frances A. Westervelt of the Bergen County Historical Society, Hackensack, New Jersey, has presented the Agricultural History Society, through the Secretary-Treasurer with a copy of the first volume of "The Farmer's Magazine." It bears the date, 1800, and is dedicated to Sir John Sinclair, Bart. of Ulbster, M.P. This particular volume appeared in at least two editions. The title page of the copy received by the Society is missing, but it has various peculiarities which tend to indicate that it is a copy of the first edition; at least, it was printed from a different set up and from older style of type than that used in the second edition. The divisions in this volume indicate that the magazine appeared as, or was designed to be, a quarterly journal. It was published in Edinburgh, and twenty-six volumes appeared before it ceased publication in 1825. The sub-title used in the second edition states that it is "A Periodical Work, Exclusively Devoted to Agriculture and Rural Affairs." Most of the contents of this magazine is devoted to agriculture in England, Ireland and Scotland. An introductory article includes an able statement of the place of agriculture in civilization and a plea for better methods, "founded upon experiment and attentive observation." The volume also contains an obituary of "the great and good George Washington, Commander in Chief of the Army of the United States of America, late President and Founder of the Federal Union of that free and rising nation" and extensive reviews of the volumes of Duke De La Rochefaucault Liancourt's *Travels Through the Unites States of North America.*

Copies of the autobiographies of two of the U. S. Commissioners of Agriculture are contained in the U. S. Department of Agriculture Library, namely, the "Memoirs of General Horace Capron," who was Commissioner of Agriculture from December, 1867 to June, 1871, and "The Recollections of a Quartermaster," autobiography of General Wm. G. LeDuc, who was Commissioner of Agriculture from July,

1877 to June, 1881. Two volumes of the Memoirs of General Capron were copied by permission from the originals in the possession of his grandson, Horace M. Capron, of Evanston, Illinois. There is a third volume in regard to General Capron's military experience but no copy of this was made by the Library of the U. S. Department of Agriculture. The LeDuc autobiography was copied from the original manuscript in the possession of his brother, Henry M. LeDuc, the original having been typewritten by General LeDuc when in his eighty-sixth year. It contains 239 pages.

Prof. W. Freeman Galpin of Syracuse University has an article, "The Grain Trade of New Orleans, 1804–1814," in the *Mississippi Valley Historical Review* for March, 1928.

A popular history of the development of the plow in America is contained in an article in *Wallaces' Farmer* for February 10, 1928, entitled "The Story of the Steel Plow," by G. A. Blackburn.

"Farms of the Famous" is the title of an interesting series of articles by Alvin H. Sanders which has been running in the *Breeder's Gazette*. The sub-titles and dates of the articles thus far published are as follows: I. Calvin Coolidge. Sept. 1927; II. Daniel Webster. Oct. 1927; III. George Washington. Nov. 1927; IV. Henry Clay. Dec. 1927; V. Richard J. Oglesby. Jan. 1928; VI. Wm. A. Harris. Feb. 1928; VII. Francisco Vasques Coronado. March, 1928; VIII. Sinnissippi Farm. April, 1928.

"The Crofting Problem, 1790–1883. I. The State of Agriculture in the Western Highlands and Islands at the End of the Eighteenth Century," by Margaret M. Leigh, is the title of an article in the January, 1928, issue of the *Scottish Journal of Agriculture*.

The January, 1928, number of the *Iowa Journal of History and Politics* includes an article, entitled "The Economic History of the Production of Beef Cattle in Iowa," by John A. Hopkins, Jr.

Chief Justice C. H. Dupont of the Supreme Court of Florida has an article on the history of the introduction and

culture of Cuba tobacco in Florida in the *Florida Historical Society Quarterly* for January, 1928.

The *Monthly Letter to Animal Husbandmen*, for April, 1928, issued by Armour's Livestock Bureau, Chicago, Illinois, contains an interesting illustrated article on Livestock in Mythology and Religion.

The attention of the readers of *Agricultural History* is called to the series of articles appearing in *Economic Geography* on the agricultural regions of the world. When completed this series will constitute a complete and comprehensive treatment of the geography of the agricultural regions of the world. The installments of "Agricultural Regions of Europe" by Olof Jonasson of the University of Commerce of Stockholm, began in October, 1925. Those of "Agricultural Regions of North America," by O. E. Baker, Agricultural Economist in the U. S. Department of Agriculture, began in October, 1926. Clarence F. Jones of Clark University is writing "Agricultural Regions of South America." The first part appeared in January, 1928. "Agricultural Regions of Africa" is being written by Homer L. Shantz, professor in the University of Illinois and president-elect of the University of Arizona. Griffith Taylor of the University of Sidney is preparing the article on the agricultural regions of Australia. A series of large, colored maps accompanying the articles indicate the agricultural regions. Another series indicates land utilization. Numerous smaller maps, charts and pictures are also used to illustrate the articles.

The *Western Pennsylvania Historical Magazine* for October, 1927, contains a study of the Economic Conditions in Western Pennsylvania during the Whiskey Rebellion by Pearl E. Wagner.

The Bureau of Plant Industry: Its History, Activities, and Organization by Fred W. Powell is No. 47 of the *Service Monographs of the U. S. Government* produced by the Institute for Government Research.

The New York State Department of Agriculture and Markets has recently issued a bulletin by J. Van Wagenen,

Jr., called *The Golden Age of Homespun*. This bulletin describes the agricultural implements, household crafts, and rural industries of the period between the American Revolution and the Civil War. It has many illustrations.

Research workers in agricultural history who have used Max Meisel's, *A Bibliography of American National History; the Pioneer Century, 1769–1865* (Brooklyn, N.Y., 1924–1928), will welcome the news that third and final volume of this valuable hand book is practically completed and that it will be brought out by the publishers before the end of the year.

MEMBERS ADDED SINCE FEBRUARY, 1928

CLARK, EMILY, Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

GUSLER, GILBERT, Editor, Agricultural News Service, 231 S. LaSalle Street, Chicago, Ill.

JOHNSON, GEO. FISKE, Editor-Director, Publications of Pennsylvania Department of Agriculture and Publicity, Harrisburg, Pa.

LEIGHTY, CLYDE E., Bureau of Plant Industry, Department of Agriculture, Washington, D. C.

LIPMAN, JACOB G., Dean and Director, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

MARQUIS, J. CLYDE, Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

MASSACHUSETTS HISTORICAL SOCIETY, 1154 Boylston Street, Boston 17, Mass.

NATIONAL GEOGRAPHIC SOCIETY, 16th and M Streets, N.W., Washington, D. C.

POPE, J. D., Agricultural Experiment Station, Auburn, Ala.

REYNOLDS, T. H., History Department, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

SCHOENFELD, WM. A., Regional Contact Office, Department of Agriculture, 519 New P. O. Bldg., Portland, Oreg.

TAPP, J. W., Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

TAYLOR, H. C., Northwestern University, 337 Chicago Avenue, Chicago, Ill.

VALGREN, V. N., Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

WALLACE, HENRY A., Wallaces' Farmer, Des Moines, Iowa.

WALLER, ALLEN G., Department of Agricultural Economics, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

WICKENS, DAVID L., Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

WOOTON, E. O., Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

Libraries

Connecticut Agricultural Experiment Station, Box 1106, New Haven, Conn.
University of Illinois, Urbana, Ill.
New York State College of Agriculture, Ithaca, N. Y.
University of Kentucky, Agricultural Experiment Station, Lexington, Ky.
The John Crerar Library, 86 East Randolph Street, Chicago, Ill.
New York Public Library, 476 Fifth Avenue, New York City.
South Dakota State College, Brookings, S. Dak.
Agricultural Library, University of Arkansas, Fayetteville, Ark.
University of Missouri, Columbia, Mo.
Oklahoma Agricultural and Mechanical College, Stillwater, Okla.
University Library, University of Western Ontario, London, Ont.
Clemson College, Clemson College, S. C.
Yale University, New Haven, Conn.
Mississippi Agricultural and Mechanical College, Agricultural and Mechanical College, Miss.
University of Virginia, University, Va.
Agricultural Library, Pennsylvania State College, State College, Pa.
University of North Carolina, Chapel Hill, N. C.
University of Wyoming, Laramie, Wyo.
University of Pennsylvania, Philadelphia, Pa.
Iowa State College, Ames, Iowa.
Virginia Polytechnic Institute, Blacksburg, Va.